

**HOW THEY MAKE THE NEW YORK TIMES**

24 Hours in the Life of the Last Great Newspaper

PAGE 70

# Popular Mechanics

HOW YOUR WORLD WORKS

84

SURVIVAL  
SECRETS  
THAT WILL

# SAVE YOUR LIFE

BARRICADE YOUR HOUSE // PACK A BAG //  
BUILD A SHELTER // CATCH A FISH IN A  
SODA BOTTLE // START A FIRE WITH A GUM  
WRAPPER // GET A DOG



The Solar-Powered Plane  
That's Flying  
Around the World!

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TOOL  
RESCUE!

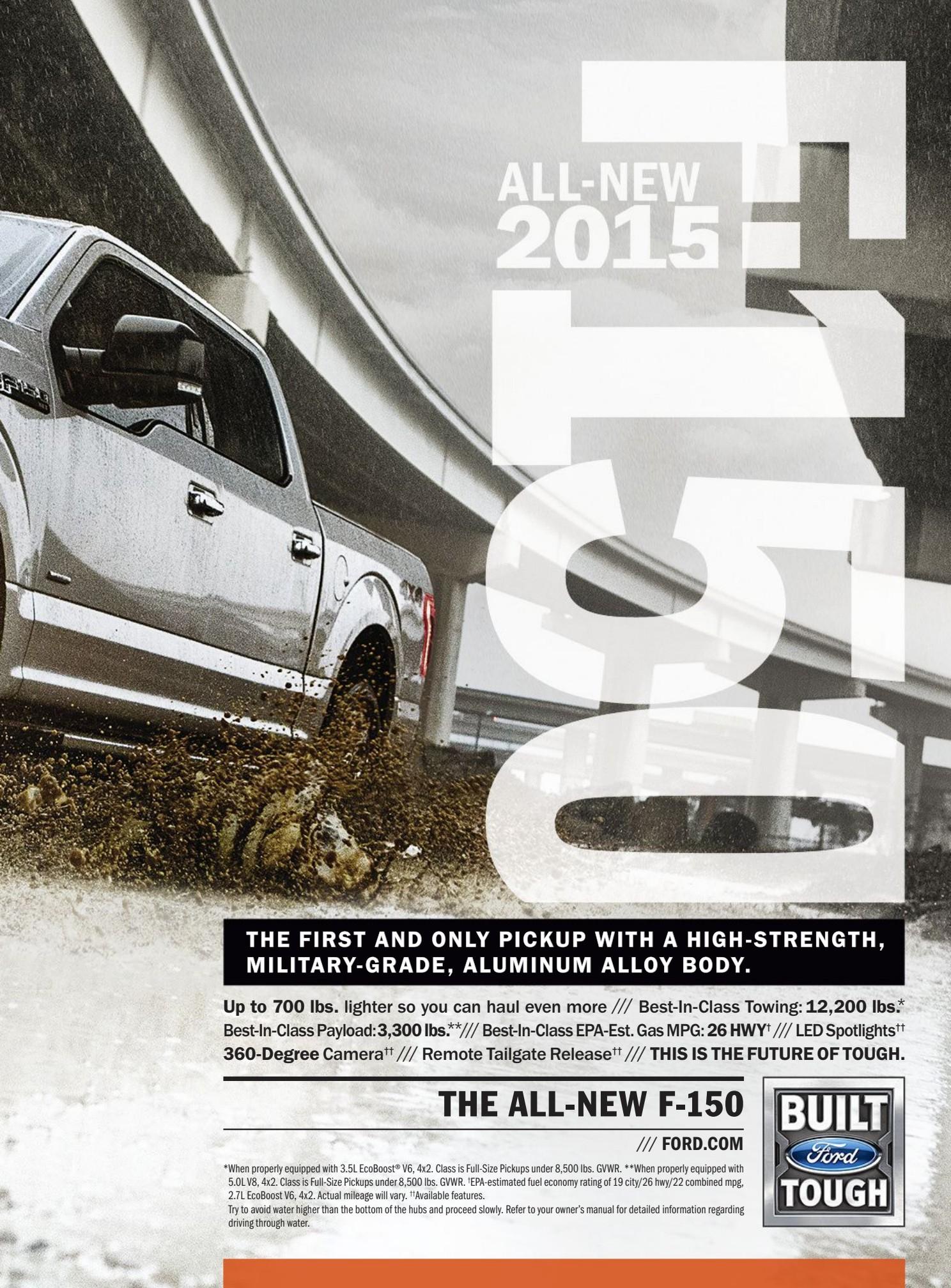
BRING  
YOUR OLD RUSTY  
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THIS IS  
NICK MEYERS,  
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SERVICE  
AVALANCHE  
RESCUE.  
You Want to Be  
With Him When the Bad  
Stuff Goes Down.  
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**INTRODUCING  
THE FUTURE  
OF TOUGH.**



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THE BIG STORY

# HOW THE NEW YORK TIMES WORKS

page 70

Pages upon pages of what's going on throughout the world arrive on your doorstep every morning. How does the newspaper of record pull it off again and again and again?

By Reeves Wiedeman

Each weekday at the paper's Queens printing facility, 300,000 copies of *The New York Times* roll off the presses.

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- A craft distillery in the cradle of Prohibition.
- The gigantic pool where the Coast Guard learns how to save your life.
- **PLUS!** Great Unknowns: Where to tread on new ground.

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- Motorcycles. Fast ones.



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### A BEAUTIFUL THING

The results of what happens when two carpenters are also skateboarders.

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### THE CASUAL SURVIVALIST

Everything you need to make it through emergency situations without having to call yourself a prepper.

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### A GUIDE TO WATCHES

A comprehensive look at how the finest watches tell time. Plus, America's only independent elite watchmaker.

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### THE PROJECT

Yes, that old table saw rusting in the back of the garage is still good. We'll show you how to bring it back to life.

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- Your morning coffee can be so much better.
- The tape measure's grandfather, the story pole.
- A YouTube music sensation teaches you how to loop.
- The very best in lawn edgers.
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### HOW TO RESTORE A CAR:

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This month at the Freedom High School auto club: repairing dents.

### ASK ROY 50

How to look good in safety glasses, caulk a kitchen backsplash, and get your lawn to bounce back after a harsh winter.

### POPULAR MECHANICS FOR KIDS 100

A monster mask made from a mop.

### ON THE COVER:

Nick Meyers, director of the Mount Shasta Avalanche Center in Mount Shasta, California. Photograph by Ian Allen. Nick's essential mountain survival tips are on page 68.

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# LETTERS



## WHO HURT YOU, BRETT?

I was not surprised to see the familiar Little Tikes Cozy Coupe in your review of children's toys ("The 100% Wholesome Holiday Toy Guide," December/January). Its popularity is evidenced by how it is so prominently featured in family yards across the country. But because I have never actually seen a single child playing in one, I must conclude that in calling it a classic, you are referring to its notoriety as a quintessential American lawn ornament.



BRETT CLEMONS

Hermon, Maine

## WHEN DID TEACHERS GET SO PESSIMISTIC?

As freshmen in high school, my classmates and I are often told that the world is a mess and we're going to have to fix it. Because of this, the future isn't something I usually look forward to. But your December/January issue, especially "A Year of Good Things," made me feel excited about the next several years and the amazingly innovative stuff yet to come. Thank you for making the world seem so much brighter.

JIMMY COLFER

Steamboat Springs, Colorado

Letters to the editor can be emailed to [editor@popularmechanics.com](mailto:editor@popularmechanics.com). Include your full name and address. Letters may be edited for length and clarity. **Subscribe:** [subscribe.popularmechanics.com](http://subscribe.popularmechanics.com), 800-333-4948.

## HOW MACHINES SAVE TINY SALMON

Let's hope the Whooshh Fish Transport System ("The Salmon Cannon," December/January) means that once again the Columbia River will teem with salmon. One question, though: How do the juvenile salmon, parr, get around these dams on their first journey from the stream out to sea?

ROGER W. HAMEL

Cedarville, Michigan

**The Answer:** According to the folks at Whooshh who invented the salmon cannon, on rivers like the Columbia many of the dams have spillway weirs, barriers that change the flow of water over the dam near the surface, where the salmon naturally swim. The weirs allow the parr to slip through and then downstream toward the sea without getting caught up in turbines. Meanwhile, newer hydroelectric dams have turbines designed to let parr easily pass.

## A LETTER TO STEVE WOZNIAK, AMAZINGLY NOT HANDWRITTEN

Steve, Steve, Steve. You're a genius, you've made more money than I will in fifty lifetimes, and Breakout is my favorite video game ever. But to claim that the iPhone is somehow a greater innovation than the pyramids ("Innovation, Defined," December/January)? Come, come. Even though, as Melville said, "I shudder at the idea of the ancient Egyptians," those structures defined a civilization. If a smartphone is defining ours, we are in a very bad way. A tool needs to be recognized as such, not glorified as a means in itself.

TODD LUNDGREN

Yakima, Washington

## THE JIBO CONTROVERSY, AND THE TOOL ARGUMENT, CONTINUED

One of the statements in the story about Jibo and its inventor, Cynthia Breazeal, is shortsighted and, frankly, just plain wrong: "Tools force you to leave the moment." I've worked with tools all my life, and they always augment the moment, aggrandizing and supporting whatever the focus is at the time.

DAVE MICHAELS

Bedford, New Hampshire

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\*As of July 2014, CASIO investigation. Function combining operation by CASIO's original solar power-generation system with current position determination by GPS (Global Positioning System: global satellite position system) and time correction by terrestrial radio wave.

# READER FORUM

PROJECT  
OF THE  
MONTH



Beginning this month, we'll pay you for your original projects and tips that we publish. Turn to page 11 for details.

## A HOMEMADE COFFEE ROASTER FROM HOWARD FREILICH

Up until about six months ago, Howard Freilich bought his coffee like the rest of us, preground and preroasted, off the grocery-store shelf. Then the former industrial electrician, who now runs his own saw-blade sales business out of his home in Richardson, Texas, learned that your typical canister of coffee is at optimal flavor for only two weeks after roasting. So he set about roasting his own beans. Two prototypes later (the first ones weren't sturdy enough), he combined a heat gun—with its casing stripped off so as not to imbue the beans with a plastic flavor—and a rotating canister on a twelve-volt gearbox. In about fourteen minutes his rig puts an even, dark roast on eleven ounces of fresh coffee beans that he buys from a nearby roasting plant. Enough to last him, yep, two weeks at a time. The man has devised a way to create some of the smallest batch coffee right on his kitchen counter. He'll probably enjoy our story on page 43, too.

### BONUS! AN UNRELATED TIP FROM HOWARD

Before opening and stirring paint that has been stored for more than a week, turn the can over and let it rest upside down for a few minutes. The paint solids that had settled to the bottom will move toward the top. When you flip the can back over and mix the paint, you'll find you get a better consistency by stirring the solids back down rather than trying to stir them up.

### THE ENDURING BOARD CHAIR

Way back in September we published the plans for a simplified Adirondack-style board chair that just about anybody could make, and just about everybody made it. Some of the best examples appear at right. Send us the results of projects you've completed from plans in the magazine to editor@popularmechanics.com, or tweet them to us at @popmech, or tag us on Instagram using hashtag #popularmechanics.



JAMIE EHLERS  
Virginia Beach, Va.



INSTAGRAM USER  
@SVK28



MATTEO LOGRANDE  
West Hartford, Conn.

### THE (NEARLY) COMPLETE WORKS OF A FORMER AIR FORCE PILOT

Kent Ashton, 67, of Concord, North Carolina, has been busy. A truncated list of his efforts over the past few years.

- Built and got flying a Rutan Long-EZ airplane, a project seven years in the making.
- Reconfigured a boat trailer to haul said airplane.
- Restored a 1974 BMW R90/6 motorcycle.
- Retrofitted two vintage Volkswagen Vanagons with Subaru motors.
- Installed new capacitors on a Heathkit amplifier and on a set of Acoustic Research speakers.
- Welded the aluminum tank of a BMW K75 motorcycle and a hydraulic tube bender.
- Built a raised garden bed for his wife.
- Built a Gray-Hoveman HDTV antenna.
- Unsuccessfully repaired a chainsaw and bought a new one. "It had spark at the plug, the timing was correct, and I rebuilt the carburetor, but I couldn't get a cough from it."

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# CALENDAR

MARCH  
2015

What our editors are doing this month. And what you ought to be.

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
1  Remove the lights I put on my cherry tree every winter, and test each strand before putting it away.	2	3	4		6 Get in line to see <i>Chappie</i> , the AI movie from District 9 director Neill Blomkamp.	7 Cook the last lasagna of the season. You never feel like lasagna in the summer.
8  Daylight Savings. We lose an hour of precious tinkering.	9  Get the driver-side window on my Bronco back on its track.	10	11	12  Ron Howard's seafaring epic <i>In the Heart of the Sea</i> comes out.	13  Clean the gutters in time for the rains. Any leftover leaves will come out easily in icy clumps.	14
15  Buy seeds for and lay out the spring garden.	16  Fill out your March Madness bracket, if you're into that sort of thing.	17  St. Patrick's Day. Don't wear green, enjoy a Guinness.	18	19  Pick up the dog crap that's been buried under the snow, which has finally melted.	20  The first day of spring. It probably won't feel like it, so clean up the workshop instead.	21
22  Dust off the window screens. It's gettin' warm out.	23	24  Mow the lawn for the first time this year. Spring comes early down south. 	25	26  Rent a hydraulic dump trailer and top-dress the driveway with fresh crushed bluestone.	27	28  Tune in to the launch that will begin Scott Kelly's yearlong mission aboard the ISS.
29  Pull out the Honda rototiller and make the garden beds my wife wants.	30  Dewinterize the boat, hook up a trickle charger, and start her up.	31				

Ryan D'Agostino,  
editor in chief

Ezra Dyer,  
automotive editor

Joe Bargmann,  
special projects  
director

You

WHO  
WOULD  
LAST?  
A GAME TO PLAY  
WITH YOUR  
FRIENDS.



After reading our big survival feature on page 54, use your newly acquired knowledge next time you're at the bar.

Deciding the order in which your friends would die in an apocalypse is easy. There's the obvious first guy—the one who refers to a Phillips-head screwdriver as

a plus sign. One of you is on medication? Dead. Can't walk up four flights of stairs without taking a break, or needs ten minutes to make up his mind about which

mustard to buy at the grocery store? Sorry, both dead. Having watched a marathon of *Survivorman* buys you only a couple of days, tops. The real debate is in the

finalists—anyone who took a NOLS course, was a Boy Scout, or grew up in something called a holler. For any ties after that, it all gets easy again: whoever can run the fastest.

**Ryan D'Agostino**

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# FROM THE EDITOR

## How Is 2015 Shaping Up?



Twenty-fifteen is a couple months old, but January and February don't count—it's cold, and everyone just keeps asking how your holidays were. Only now is the year starting to develop any kind of personality, and it's time to declare a theme, at least here at Popular Mechanics: empowerment. Anything is possible this year. You're in control. You can dream up a product, design it using CAD software, and learn to print it on a 3D printer. And: You have a Home Depot or a Lowe's within fifteen minutes of your home, so you can wander the million aisles, then make or fix anything. And: You have a billion ways to tell the world about your creations, most of which involve nothing more than the phone in your pocket. We are living in the golden age of people who want to do stuff.

Here's all I ask: Tell us how we can help you.

This month you might notice that the first bunch of pages after the table of contents are mostly about you. Your letters. Your projects made at home. The contests we hope you will enter to show your skills (and to win prizes). The magazine opens with a veritable Popular Mechanics reader marathon. And all our contact information is here, so you always know how to reach us. We've revamped our efforts on the Twitter and the Instagram and the Facebook and everything else, so we're always ready to talk and swap photos and conspire about cool things we could do together.

We hope you're finding inspiration in every issue. This month we have an expansive, highly informative, mostly serious, occasionally humorous section about survival, starting on page 54—how to get through impossible situations that will probably never happen. There's also a fascinating story about how the world's most venerable and important news-gathering organization, *The New York Times*, operates, starting with the writer who writes the story and ending with the enormous presses that print the paper night after night after night. What we learn from the story is that the world's most important news-gathering operation is just people who have a common purpose, doing their jobs with care, day after day after day. And I guess what we learn from that story, too, is that anything is possible. What the *Times* does every day seems impossible, and what the survival experts we interviewed do out in the wilderness seems impossible. And yet they do it. I've found myself thinking about these stories lately as I stare at some impossible-seeming task or another, at home or at work. They are empowering. They make things seem possible. Happy New Year. Go make a birdhouse.

**RYAN D'AGOSTINO**

EDITOR IN CHIEF

**WRITE TO US, EARN SOME DOUGH.**

If we find your original project and the photos thereof fit for these pages, we'll pay you \$100 for your efforts upon publication. And if you send us a new and useful home, auto, or DIY tip—and we decide to run it—we'll give you \$50. Call it a little incentive for being an engaged reader. You can email both tips and projects to [editor@popularmechanics.com](mailto:editor@popularmechanics.com).

# CONTESTS!



Imagine having  
this beauty  
standing next to  
your grill. Summer's  
almost here.

## YOUR "HOW TO MAKE ANYTHING" SWEEPSTAKES WINNER

As part of our How to Make Anything issue (September 2014), we asked you to share your projects with us on Instagram for a little sweepstakes. The winner of said sweepstakes is Mike Kuhl of Lincoln, Nebraska. What he made is a slick standing cooler rigged with interior lighting—making bending over and fishing for a cold one in the dark a burden only our fathers will know. For his efforts, Mike won a \$145 Minimalist Lamp by Meriwether of Montana, and, of course, this mention here.



## TWO QUICK ANNOUNCEMENTS

1

Some of you are anxiously awaiting the results of the first Popular Mechanics Home Workshop Challenge that we issued back in December—the one where we asked you to make something out of a single sheet of plywood. We got some great entries: tables, puzzles, nativity scenes. We're in the midst of judging. You can expect to see the plans for the winning project on this page in the April issue.

2

We are taking candidate submissions for America's Most Popular Mechanic right up until February 15. Let us know about the car technician you and your vehicle cannot do without. Go to [popularmechanics.com/most-popular-mechanic](http://popularmechanics.com/most-popular-mechanic) and fill out the entry form there. Our selection for the best mechanic in the country will be announced soon.

**Popular Mechanics**

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# HOW YOUR WORLD WORKS



## THE SUN PLANE

They're the Amelia Earharts of clean energy: This month Swiss pilots Bertrand Piccard and André Borschberg will attempt to become the first people to circumnavigate the world in a solar-powered airplane. Their twelve-leg, 21,748-mile trip will take five months to complete, beginning and ending in Abu Dhabi, with stops in North Africa or southern Europe, and the United States. We had a few questions. BY RACHEL STURTZ

The Solar Impulse 2 in the middle of its first test flight on June 2, 2014, near Payerne, Switzerland.

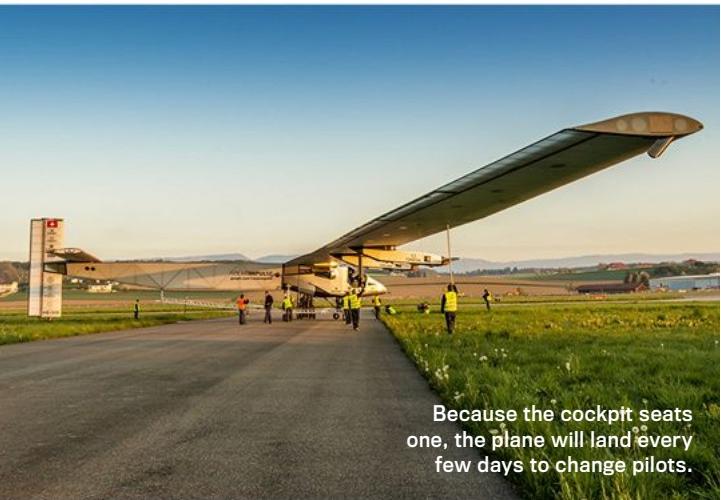
How big is this thing?

### Solar Impulse 2

WINGSPAN:  
236 feet  
WEIGHT:  
5,000 pounds

### Boeing 747-400

WINGSPAN:  
211.5 feet  
WEIGHT:  
394,660 pounds



Because the cockpit seats one, the plane will land every few days to change pilots.

#### Who are these guys?

Bertrand Piccard (far right) is an aeronaut who copiloted the first nonstop trip around the world in a balloon in 1999. In 2003 he teamed up with André Borschberg (right), an engineer and former fighter pilot. With a crew of eighty engineers and technicians, the two devoted the next twelve years to developing one of the most innovative solar-powered machines on the planet.



#### Will this be their first attempt?

At traveling around the world, yes. There was an earlier prototype, Solar Impulse 1, that broke eight records, three of them when Borschberg flew it for twenty-six hours straight in the first night flight

in the history of solar aviation. They're now on to Solar Impulse 2, which has greater energy density in its 1,400 pounds of lithium-ion batteries and improved 17.5-horsepower electric motors that spin the propellers with 94 percent efficiency.

#### How comfortable is the plane?

Not very, especially considering that it is unpressurized and has no heat. Borschberg and Piccard will have oxygen tanks to deal with the altitude, but they'll be forced to endure temperatures that fluctuate between minus 4 and 86 degrees Fahrenheit with only small warmers for their hands and toes.

#### How do they sleep?

They don't, really. Since only one pilot can fit in the 106-cubic-foot cockpit at a time, he is allowed just six twenty-minute naps a day while the plane is on autopilot. Both men have trained in meditation and self-hypnosis to rapidly enter deep sleep and wake up alert.

#### Is there a bathroom?

The longest and most demanding leg of the trip is a five-day stretch of continuous flight over the Pacific, so it wouldn't be fair to expect the pilot to wait for a rest stop. The seat, which can recline completely for naps and physical exercise, also serves as a toilet—by removing the cushion of the seat as you might on a private plane.

#### If it's a solar plane, does that mean it can't fly at night?

The plane uses stored energy to fly in the dark. So as not

to exhaust its reserves, Solar Impulse 2 takes advantage of gravity, gradually gliding down to an altitude of 5,000 feet at night. During the day the pilot regains a cruising altitude of 28,000 feet—where there is lower air density and drag—and can reach a top speed of eighty-six miles per hour while the batteries are recharged.

#### Are they scared?

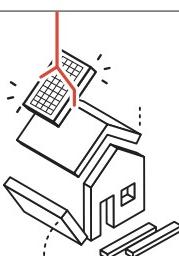
The plane has never flown in inclement weather or periods of turbulence. In case they do run into trouble, the two have been practicing parachute landings and treading water in the North Sea. "If oxygen runs low, if there's not enough energy to fly through the night, or if autopilot doesn't work, we'll end up in the water," says Borschberg.

#### Okay, so what's the point of all this?

Although Piccard admits that solar-powered commercial flights may never happen, "we would be able to cut the world's energy consumption in half if we replaced old technology with current technology," he says. They also hope to inspire more businesses to consider clean energy. They've already heard from companies that want to use their technology to replace satellites with cheap, unmanned aerial vehicles for transmitting telecommunication services to developing countries.

UPDATE

#### SOLAR IN YOUR HOME



It's all good news, with one caveat: We need Congress to extend the solar investment tax credit in 2015. Even if that doesn't happen, solar prices are dropping rapidly on their own. According to the National Renewable Energy Laboratory, the cost of solar panels has fallen by 84 percent in the past fifteen years. Plus, homebuilders are beginning to install rooftop panels as a standard feature—an option that is significantly cheaper than adding them later. You can also buy into microgrids, community-owned islands of solar panels independent of the national grid, that can be used to power your home. And Tesla's new Gigafactory is scheduled to begin producing lithium-ion batteries in 2017, with the goal of doubling the world's lithium-cell production and revolutionizing solar-energy storage. That would be great, if it happens.

# **"HOME OF THE BRAVE"**

## **MEN'S HOODIE**

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*Boldly emblazoned on the back is a patch of a soaring eagle, its wings bearing our flag's stars and stripes, surrounded by the words for which we stand LAND OF THE FREE and HOME OF THE BRAVE*

### **An All-American Salute with Star Spangled Style**

It's time to stand up and stand out as proud Americans. And now you can in dramatic fashion, with our custom-crafted "Home of the Brave" Men's Hoodie, exclusively available from The Bradford Exchange. Crafted in easy-care black cotton blend knit, with brushed fleece on the inside, it showcases a stirring eagle patch accented with our flag's stars and stripes on the back along with the boldly printed motto: LAND OF THE FREE and HOME OF THE BRAVE. An American flag is embroidered on the front chest.

You'll notice plenty of design detail throughout this apparel exclusive, like contrasting gray lining in the hood, front pockets, knit cuffs and hem, a full front zipper, and even chrome-look metal tippets on the hood drawstrings. Imported.

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This custom hoodie is available, in sizes Medium to XXL, only from The Bradford Exchange, and only for a limited time. So don't miss out—order yours as soon as possible! A remarkable value at \$89.95\*, you can pay for it in four convenient monthly installments of \$22.49 each. To order yours, backed by our 30-day guarantee, send no money now; just fill out and send in your Reservation Application today!

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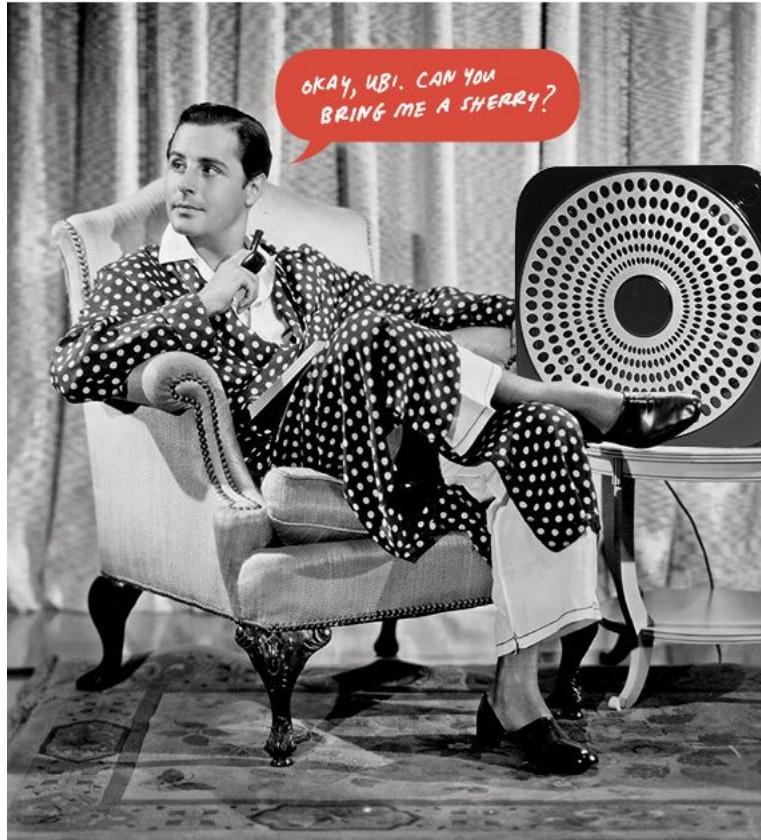
E27501

\*Plus \$11.99 shipping and service. Please allow 2-4 weeks after initial payment for shipment. Sales subject to product availability and order acceptance.



## THE UPGRADE: SPEAKERS THAT FLOAT

A little secret about Bluetooth speakers: They're all pretty much the same. Some are clearer, some are louder, some are better at working after you drop them into the pool, but for the most part you pick a price point and you get music. Which is why speakers like the Crazybaby Mars (\$189) are following the example of the Om/One (\$199) we covered in December, using opposing magnets to float above a base. They're no better than existing speakers, but they're also no worse. They're definitely more interesting.



## SIRI FOR YOUR LIVING ROOM

Technology you might forget is on your phone becomes useful when you take it home.

BY ALEXANDER GEORGE

**I** USED SIRI—ONCE, TO SEND A TEXT IN THE WINTER when I didn't want to take off my gloves. After that, never again. And I don't think I'm alone. As good as voice recognition gets, aside from the occasional party trick, most people I know seem to forget it's there. A few companies, however, think they can change that. We just have to be in the right setting.

Ubi (\$299) is a Wi-Fi-connected, wall-mounted speaker the size of a Wonder Bread PB&J, with an always-on microphone that listens for your commands. (In what seems like a move to keep pace, Amazon soft-launched

a similar product last fall, the Echo, right, available by invitation only.) Say "okay, Ubi," from within eight feet, and it beeps twice in acknowledgment. From there you can ask it anything. With practice it almost feels natural to pause your Netflix movie and ask, "What was Charlie Chaplin's first film?" After a two-second pause—long enough to query Google—Ubi will tell you it was *Making a Living*, from 1914. Ubi follows basic commands too. I asked it to play music by Howlin' Wolf, and its twin three-watt speakers played tracks from Grooveshark, the free music-streaming service. After boiling water, I told it to remind me in six minutes to check if my pasta was al dente. You can also coordinate Ubi to work with smart-home devices through IFTTT (If This Then That, software that lets you program a response to a trigger event, like saving every photo you post to Instagram in your Dropbox storage). After a few minutes of setup, I could tell Ubi to change my Philips Hue bulbs to red or to turn on a space heater I connected to a Belkin WeMo switch.

Ubi's most distinct advantage, however, shows up when you're in a group. When a friend and I were certain we knew the capital of New Zealand, rather than removing myself from the conversation and getting lost in my phone, I asked Ubi. Everyone heard the answer. (It's Wellington, by the way.) You get the immediacy of the Internet without the isolation.

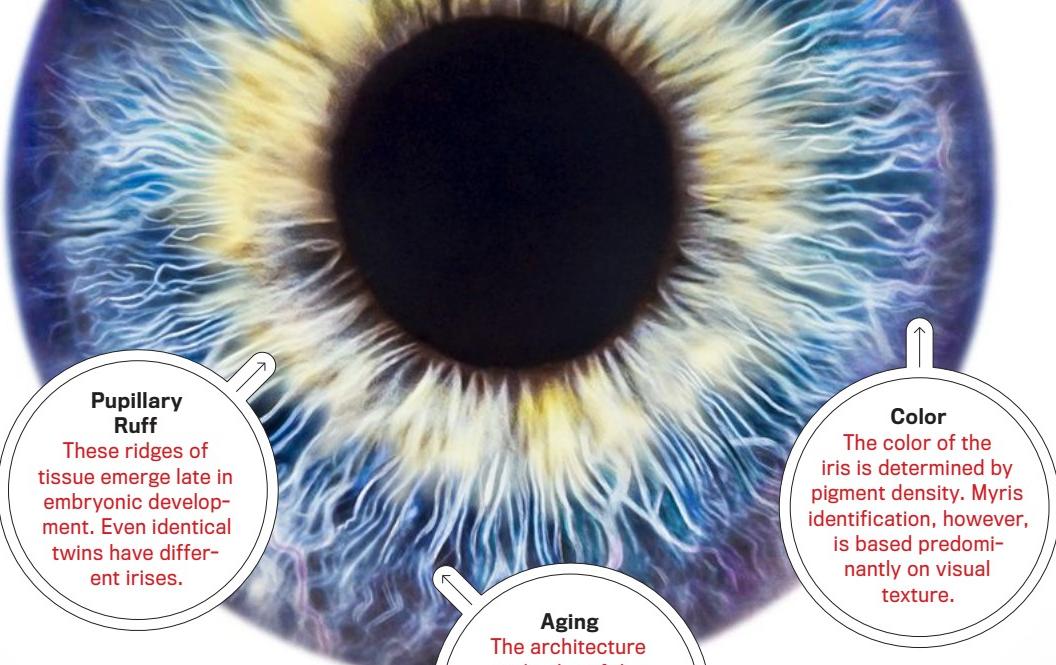
If only the experience were more consistent. Autocorrect and Google suggestions can compensate for my infantile spelling, but telling Ubi to "turn off the light" was met with silence, since my IFTTT command was listening for "turn off the lights," plural. Plus, over three days, several TV actors woke Ubi by saying "okay." But those flaws can be fixed. The real obstacle is us, and how quickly we can come around to the idea of talking to something that isn't human. The home, with its inherent privacy, is a great place to start.



The Amazon Echo functions much like Ubi. It costs \$99 for Prime members and \$199 for everyone else. But you can get one only if you're lucky enough to be invited.



The Myris. Reading irises is up to 150 times more accurate than fingerprints.



#### Pupillary Ruff

These ridges of tissue emerge late in embryonic development. Even identical twins have different irises.

#### Color

The color of the iris is determined by pigment density. Myris identification, however, is based predominantly on visual texture.

#### Aging

The architecture and color of the iris subtly change with age, which could affect Myris's ability to identify you.

MEANWHILE, IN ONLINE SECURITY ...

## YOUR NEXT PASSWORD: YOUR EYEBALL

People can hack your passwords. But they can't hack your eyes.

BY SARAH Z. WEXLER

**YOUR PINTEREST ACCOUNT IS ABOUT TO** be safer than ever. EyeLock, a company known for making iris scanners for security checkpoints at banks, recently introduced an at-home device called Myris (\$280). It stores your passwords locally, instead of in the vulnerable cloud, and encrypts them. The only way to access them is by scanning your eyeball.

Setup is simple: Plug the palm-size Myris into your computer's USB port and look into the camera. Once it has identified and logged some 240 unique points in your iris, you can create a username and add your pass-

words. After that you never have to type a password again. Just sign in with your eye when you turn on your computer and all of your passwords are automatically input, except for time-sensitive passwords for things like banking sites, for which you'll need a rescan to access. When Myris runs smoothly, you wait about ten seconds and see a brief flash of light. But when the device acts up, which in our tests was a little less than half the time, expect a few retries—and to see spots for a minute or so after.

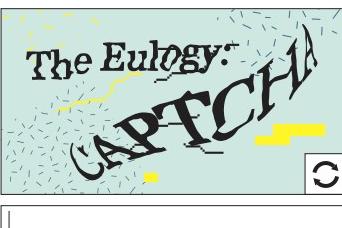
It's impressive, and it's allegedly unhackable. While finger-

prints offer about twenty points of difference, the human iris has twelve times that. Not even identical twins have the same iris texture. The only downside, other than those pesky (but temporary!) blind spots, is that in order for Myris to work, you need to have it with you. So if you have your laptop but forgot your fancy new scanner, or if you're checking your email from your phone, you'll still have to type in your password. Which will be even harder to come up with after months of not having to remember it. (Hint: It's your dog's birthday.)



#### The EKG Password

The upcoming Nymi Band (\$149) identifies you with your heartbeat, then uses Bluetooth to automatically log you in to any application.



→ You know CAPTCHA, the hard-to-read jumble of letters, numbers, and obfuscating lines that supposedly confirm your humanity every time you go to buy Taylor Swift tickets? Well, it's getting phased out. Besides being infuriating to real people, especially those using mobile devices, CAPTCHA is no longer fooling the robots. Succeeding it is Google's No CAPTCHA reCAPTCHA, a much simpler set of boxes you click in answer to basic prompts ("Pick your favorite color," "I'm not a robot") that started rolling out late last year. The system analyzes your IP address, browser cookies, and even the way your mouse moves. It's a way to prove you're human, and it's finally humane.

HOW YOUR  
WORLD  
WORKS

MAKERS

# FROM GRAIN TO GLASS

Where Prohibition began,  
a distiller sets up shop.

BY FRANCINE MAROUKIAN

**T**HE FIRST DISTILLERY WITHIN THE CITY limits of Evanston, Illinois, Few Spirits was founded in 2011 and represents the grain and the glory of the great American Midwest. "We make grain spirits because we're in the country's breadbasket," says founder Paul Hletko, whose distilling philosophy is "grain to glass." "We're able to source our corn, wheat, and rye regionally, much of it from farm cooperatives."

A former patent attorney, Hletko overcame antiquated laws in order to root Few in Evanston, one of Prohibition's birthplaces. Today the alley entrance still evokes the feeling of that era's hidden production. Located in a former repair shop for "cars of unknown ownership," Few has a 2,700-square-foot distilling floor and a 400-square-foot tasting room.

Although the science of the distillation process is relatively simple, the art is not, and the approach of the distiller is the distinguishing factor. "We do not buy a neutral spirit base made elsewhere and then distill it into our own," Hletko says. "We make the grain alcohol here. We control the ingredients, techniques, and equipment."

For his bourbon, Hletko mixes a bit of Southern tradition and Northern style in a mash bill, or grain recipe, of 70 percent corn, 20 percent rye, and 10 percent two-row malt (a regional barley). The bourbon is then aged in new white oak barrels, which Few sources from a Minnesota cooper. "Because the frost-free growing season is shorter there, the tighter grains of the wood produce a better balance of pepper and vanilla and make the tannins more intense," he says. At the cooperage, a cooper places an open-ended barrel over a superhot flame and torches the inside



When Paul Hletko decided to make a derelict garage the home of his company Few Spirits four years ago, he got quite a shock. "The first time I came in, there were two guys stripping a car," Hletko says. "It was arresting."

until it reaches the desired char level, which for Hletko is on the heavier side. Darker chars caramelize the wood sugars to create more intense vanilla notes and a richer color.

Of the four spirits Hletko makes, the American and Barrel gins share a link to his old hobby: beer brewing. "You can't just make a good gin," he says. "You have to make a good gin that is different." That's why Hletko adds American-bred Cascade hops, which deliver a citrus note that you won't find in other gins. Hletko also ages his amber-toned Barrel Gin in oak barrels previously used for the company's bourbon and rye, as well as in unused barrels. The gin from the different barrels is then combined to attain a balance of flavors and color. But after all that work, the label can only say it's barrel gin, because the government won't allow it to be identified as barrel-aged. "They say you can't put gin in a barrel," Hletko explains. "Although I tell them that we do have the technology: We call it a funnel." Out here in the heartland, where Prohibition got its start, Hletko understands that not all laws are logical.

## THE COCKTAIL: Few Spirits Barrel Gin Negroni

Not quite a gin Negroni, not quite a bourbon Boulevardier. The orange bitters highlight the citrus rind, and the bold Barrel Gin cuts through the bitter Campari.

### Ingredients

$\frac{3}{4}$  ounce Few Barrel Gin  
 $\frac{3}{4}$  ounce Carpano Antica Formula Sweet Vermouth  
 $\frac{3}{4}$  ounce Campari  
3 dashes Fee Brothers Orange Bitters  
1 orange peel slice

### Instructions

Stir first four ingredients in a glass with ice, then strain into a chilled cup. Twist the orange peel to infuse the surface with oils, and discard.



HOW TO PACKAGE  
AN AMERICAN  
CRAFT SPIRIT,  
2015

**THE LABELS:** Few's labels, which replicate woodcut prints, feature singular wonders from the 1893 World's Columbian Exposition in Chicago.

**THE LOCATION:** Evanston, Illinois, a historically dry town founded by Methodist ministers and home to Northwestern University.

**THE LADY:** Few's namesake, Francis Elizabeth Willard (1839-1898), was head of Evanston's Woman's Christian Temperance Union. Note the initials.

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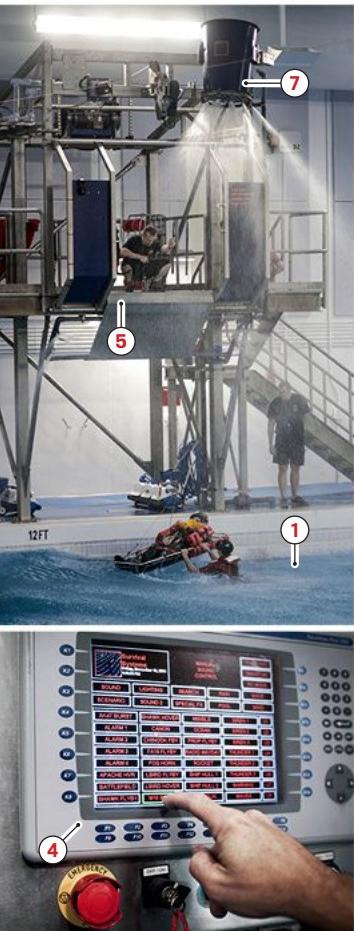
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# THE WORLD'S WILDEST POOL

At the Coast Guard's rescue-swimmer indoor training facility, the water is not fine. That's the point.

BY STEPHEN MADDEN



The main pool **①**, which is 25 meters by 50, holds 1.2 million gallons of water and is a uniform 12 feet deep except for 4-foot ledges on three sides. A movable bulkhead with a massive overhead curtain can create two separate training environments for the classes that come through. Every weekday the swimmers spend two hours in the water working on their conditioning. That means endless laps in a mask, snorkel, and fins, and the occasional order to pair up and move a brick along the bottom of the pool—the 82-foot length of the pool—with one swimmer at a time coming up for air.

An adjacent 250,000-gallon pool houses the Dunker ②, a hoist that can flip over accurate mockups of a small boat and a helicopter so crews can practice escaping from downed

capsized craft **3**. The entire room, including a wave machine, is controlled from a single panel on the hoist **4**.

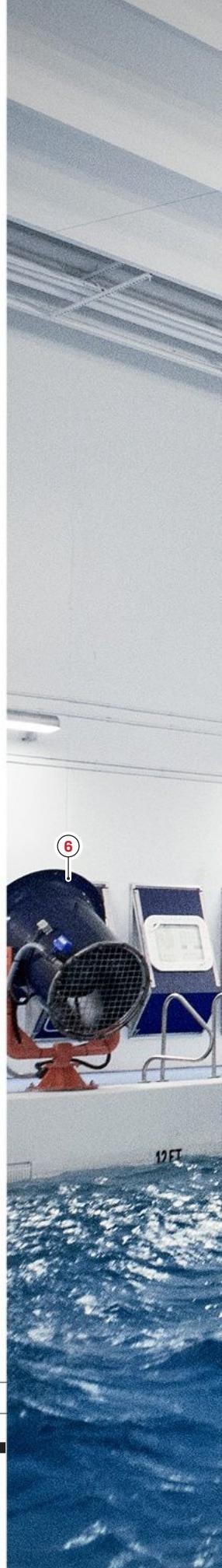
Twin towers on either side of the bulkhead feature platforms ⑤ fifteen feet above the big pool's surface—the height at which swimmers jump off hovering helicopters during missions. The platforms are equipped with the same hoists that are attached to the MH-65s the Coast Guard flies during rescues.

Two giant fans **6** create everything from zephyrs to seventy-knot winds, while nozzles direct water into the gusts to produce driven rain and spray. A fan above the towers **7** simulates propeller wash. And roaring above those fans: recordings of helicopter props and engines, thunder and heavy winds, all played at realistic volumes.

**Flashing strobes provide simulated lightning. The devices ramp up the difficulty level in skill training—towing a buddy or trying to free a pilot from his parachute.**

Both pools have wave machines that can produce rough seas with waves as high as three feet. In the big pool two high-volume fans force air into a caisson behind the building. The caisson drops, pushing water down. When it rises again, so does the water, creating waves.

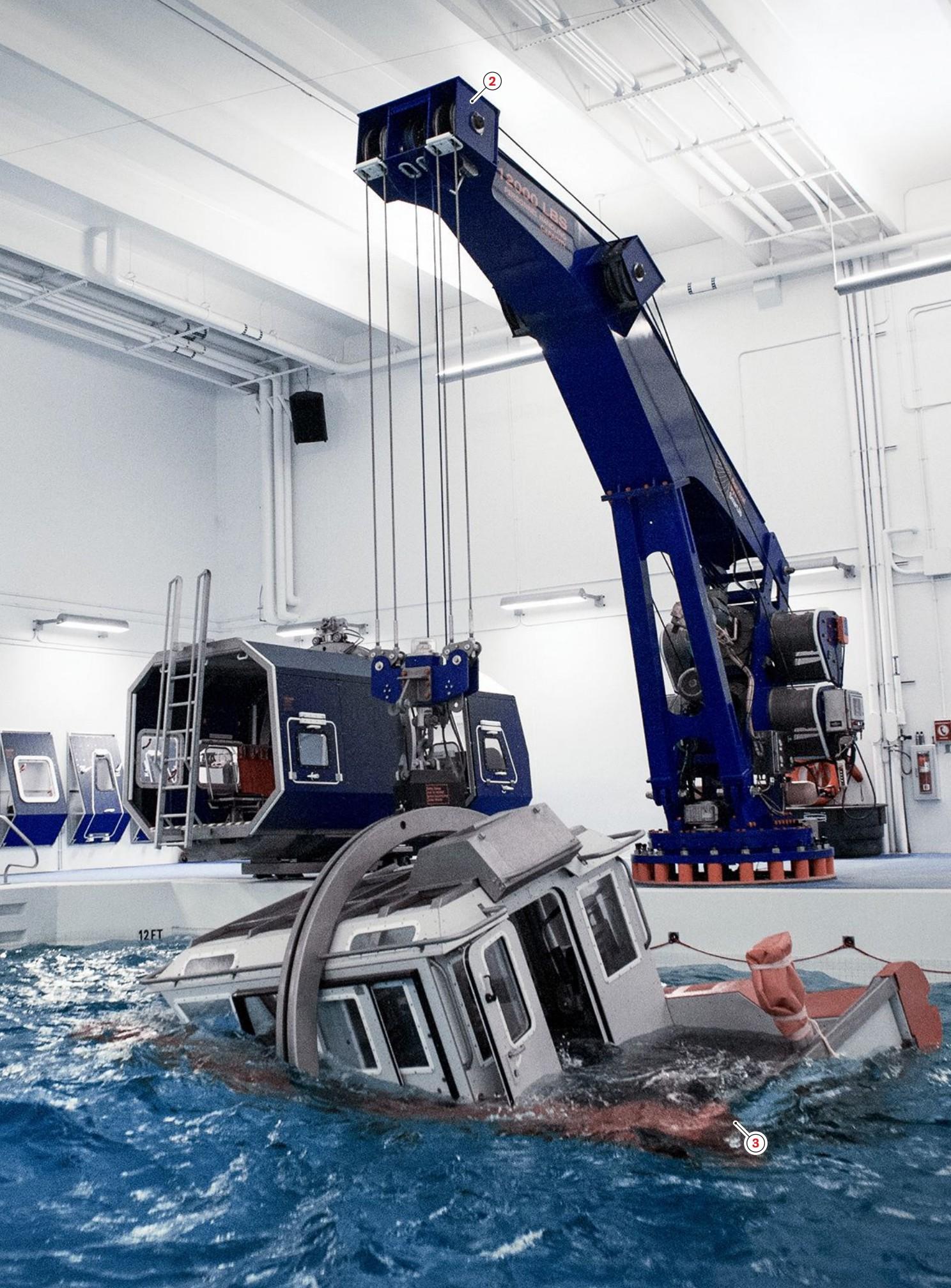
In the smaller pool a giant ball floating on the surface is pulled down on its moor line and then released repeatedly to create wave action. Water levels are kept a couple of feet below the maximum height—there are no spill lanes like those you'll find in a competition pool—to magnify the effect of the roiling water.



# COULD YOU PASS THE ENTRANCE EXAM?

- Swim 500 yards in 12 minutes ► Run 1.5 miles in 12 minutes

- Do 40 push-ups and 50 sit-ups in 2 minutes each. ► Do 3 pull-ups and 3 chin-ups without stopping.



2

3

# HOW TO MAKE A SUSTAINABLE HOSPITAL

Hospitals are energy hogs. They don't have to be. **BY KEVIN DUPZYK**

**A**N EARTHQUAKE CAN HAVE POSITIVE SIDE EFFECTS. LIKE IN 1994, when, in response to an earthquake that damaged many hospitals in the San Fernando Valley, California issued seismic safety regulations specifically for patient-care facilities. But they were never instituted—until last summer. Now a huge number of California hospitals are being retrofitted or completely replaced, and officials are seizing the opportunity to address sustainability by incorporating some of the most advanced technology available. The result is a petri dish of innovation—and a model for the industry.

**1 Plant a garden.** Rooftop gardens reduce storm-water runoff and provide better insulation, which can result in an average savings of up to 40 percent on heating and cooling bills. Plus, research shows that green space helps the healing process. University of California-San Francisco Medical Center at Mission Bay features 1.2 acres of green in five rooftop gardens, three of which are accessible to patients.  
**Where:** San Francisco  
**When:** February 2015

**2 Turn off the heat-selectively.** El Camino Hospital created something of a connected home setup, which integrates room-based sensors, the hospital's HVAC system, and patient records to control heating and cool-

ing. When a room is empty, the system adjusts to the minimum ventilation settings. When a patient is present, he can choose the temperature through a program on his TV. The program is saving the hospital about \$151,000 per year and reducing the surprising number of injuries sustained by patients who leave their beds to change the thermostat.  
**Where:** Mountain View  
**When:** June 2014

**3 Replace the floors.** Hospitals are the last places that should use even slightly hazardous or carcinogenic materials, so the new Oakland Medical Center installed rubber flooring that can be maintained without harsh industrial cleaners. It has an added advantage of reducing



both hospital noise and joint impact. Good news if you just got your knee replaced.

**Where:** Oakland  
**When:** July 2014

**4 Make your own power.** Sutter Regional Hospital meets an estimated 70 percent of its energy needs through on-site fuel cells. The solid-oxide cells are stacks of ceramic discs painted with conductive inks. Put oxygen on one side and natural gas on the other and oxygen ions flow between them to produce electricity—clean electricity not from the grid, and thus not derived from coal or hydroelectric power. Which means Sutter reduces

its annual contribution to CO<sub>2</sub> emissions by nearly 600,000 pounds, and water use by 1.2 million gallons.

**Where:** Santa Rosa  
**When:** October 2014

**5 Stop wasting rain.** Lucile Packard Children's Hospital captures rainwater, condensation from the HVAC system, and any other spare droplets it can, and stores it in a 110,000-gallon underground reservoir. That water isn't sterile enough for patients, but it can go toward irrigation, lessening the draw on the clean water supply.  
**Where:** Palo Alto  
**When:** December 2016

## THINGS YOU MAY ENCOUNTER AT THE DOCTOR'S OFFICE

THIS MONTH:  
THE EYE  
DOCTOR



**Autorefractor.** Measures cornea curvature as an object shifts in and out of focus, then averages those readings to approximate your prescription.  
**PM's VERDICT:** Easy, relatively accurate, especially good for kids.



**Optical coherence  
tomography machine (OCT).** Provides a cross section of the retina, often precluding the need to have your pupils dilated.  
**PM's VERDICT:** Great, but requires a skilled operator.

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# IS THERE ANYWHERE LEFT IN THE UNITED STATES THAT IS SO REMOTE I COULD BE THE VERY FIRST HUMAN TO STAND THERE?

**A** THERE ARE PLENTY OF PLACES. THE INSIDE OF MY CLOTHES dryer, for instance. I'm pretty sure nobody's ever stood in there. Come on over and make history, Commander Armstrong.

Actually, while this is obviously an impossible question to answer definitively without a time machine and a helluva set of binoculars, there is reason to believe that such places—small corners of our country unsullied by the soles of man—do exist. Possibly in Alaska, but that's cheating—they're just not easy to find in the contiguous states. "The places left are the ones that are really hard to get to," says Rich Rudow, an explorer and board member of the Coalition of American Canyoneers, and notably a man whose last name Microsoft Word spell-check suggests be changed to "rubbdown."

If anybody's stood on virgin ground in the lower 48, it's Rudow, who specializes in exploring narrow fis-

Do you have unusual questions about how things work and why stuff happens? This is the place to ask them. Don't be afraid. Nobody will laugh at you here. Email [greatunknowns@popularmechanics.com](mailto:greatunknowns@popularmechanics.com). Questions will be selected based on quality or at our whim.

sures in the earth throughout the Southwest known as slot canyons. They may be thousands of feet deep and are carved over centuries or millennia by flowing water. Rudow is credited with a hundred or so slot-canyon first descents, meaning nobody's preceded him down the canyon—at least not so far as anyone knows. Exploring these features safely requires superior physical ability, along with significant technical skill and specialized equipment. Assuming you possess none of these, perhaps the dryer is your best bet. Stop by anytime.

## Is radiation from my cellphone affecting my sperm count? And if it is, would wearing that radiation-shielding underwear I've seen actually help?

On the whole, cellphones have been a boon to the male reproductive function, giving rise to such modern courtship rituals as the late-night booty call, bored-at-work sexting, and, of course, the old "I think I dropped my phone down your pants" gambit. Even so, some research does suggest that cellphone use may reduce male fertility.

In assessing such matters, researchers concern themselves with three specific measures: motility (how many sperm cells swim upstream), viability (how robust they are), and morphology (how well-formed the cells are). A 2007 study at the Cleveland Clinic found that all three fertility measures deteriorated among 361 male subjects as their reported cellphone use rose.

However, other studies have failed to demonstrate a correlation between cellphone chatter and damaged baby batter. Settling the question conclusively would be extremely difficult for a few reasons, including the challenge of assembling a true control group, namely, a large enough pool of men who don't use cellphones.

As for the underwear, while apparently it does shield your junk from radiation (it's more than

99 percent effective, one study reported), nobody knows whether radiation is even the culprit, assuming cellphones do, in fact, affect fertility. What we do know for certain is that announcing that you're wearing antiradiation briefs is 100 percent effective at preventing you from getting laid.

## If it takes less refining to make diesel, then why does it cost more?

If a third-world factory can slap together a TV set for 39 cents, how come my last flat screen cost a grand? Because how much something costs to produce has little direct bearing on how much it sells for. Indeed, Econ 101 teaches us that market price is determined by two factors—supply and demand. (Though, for the record, the cost of refining diesel has risen of late, due to new regulations that require the removal of sulfur from the fuel.)

Demand for diesel fuel in the United States remains low by worldwide standards. Truckers use it, of course, but very few American passenger vehicles do. In other countries, conversely, they love, love, love their diesel-powered vehicles. Can't get enough diesel. *iMas diesel, por favor!* They'd wash their dogs with it if they could.

The upshot of this is a double whammy: U.S. refiners are producing less diesel (because there is less demand), and they are exporting more of what they do produce to countries where there is more demand. This results in—drumroll, please—a reduced U.S. supply relative to a low but stable demand and therefore—another drumroll, please—a higher price.

It is true that diesel carries a higher federal excise tax than does gasoline (\$0.06 more per gallon), but that's a minor contributor, conceived as a way for the trucking industry to compensate the rest of us for the wear and tear it puts on the highways, to say nothing of the cultural damage inflicted by the Smokey and the Bandit movies.

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-Nielsen Mobile Insights, Q3 '14



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# CARS

By Ezra Dyer

## UP AHEAD:

- 34 Why stop/start engines need to go.
- 35 The best new midsize truck is . . .
- 37 The fastest motorcycle ever.



Three wheels, no roof, and 173 horsepower—an insurer's dream. But it's pretty safe, actually.

## What in the Name of Henry Ford Is That?

It's the Polaris Slingshot, and it's street-legal.

**T**HE FIRST TIME YOU SEE THE POLARIS SLINGSHOT coming at you, it looks like a set piece from some big-budget Marvel movie—this is a mode of transportation for someone with a secret identity and superpowers. There's that wide arachnid front end skimming the pavement with spats and spoilers and open-wheel fenders, a prototype racer from the future. Then the rest of the machine comes into view, and it gets even wilder.

The back end tapers to a point, where a hefty swing arm carries a carbon-fiber-reinforced belt that drives a single tire. From the front seats forward, it's like a car—bucket seats, steering wheel, GM Ecotec four-cylinder hooked to a five-speed manual transmission. From the rear it's a giant mutant motorcycle. And that distinction makes all the difference—the Slingshot's odd wheel count both defines its identity and allows it to exist in the first place.

Because the Slingshot has three wheels, the federal government classifies it as a motorcycle. That means, depending on the state, you might need a motorcycle license and a helmet to drive it. Of course, it's not really a motorcycle, but it's certainly not a ▶

2015 POLARIS SLINGSHOT

PRICE: \$19,999

AVAILABLE: NOW

### THREE THINGS THAT HAPPENED WHILE I HAD THE SLINGSHOT

A woman driving in front of me stopped her minivan, got out, walked over, and said, "Okay, what is this?"

As I was putting a Captain America helmet on my kid, a guy who looked like Jack Palance said, "I like your style."

Outside the grocery store, six high schoolers stopped to take photos. I gave each one a ride around the block.

car either. At any rate, the motorcycle designation gave Polaris, maker of snowmobiles and off-roaders called side-by-sides, the freedom to design a machine with no doors, no roof, and no windshield (it's an option). There's no climate control, no airbags. This is a minimalist transportation experience—1,725 pounds and the wind in your face. The Slingshot makes a Lotus Elise look flabby and decadent.

Whether or not you think the Slingshot is quick depends on your frame of reference. By car standards, it's got a great power-to-weight ratio, with the 2.4-liter four-cylinder putting out 173 horsepower. Zero to sixty is probably around five seconds, and with traction control disabled the Slingshot will light up its rear tire. That said, Ducati riders accustomed to ten-second quarter-miles

won't find that sort of thrill.

The handling, as you'd expect, is somewhat different from a car's. Without the stabilizing effect of dual rear wheels, turn-in is instant, but a given corner could require a few steering corrections. Still, the body stays flat, and the ride is remarkably supple. Potholes, though, are a peril. When you straddle a crater between the front wheels, you can feel a mule kick from the back a moment later as the centrally mounted tire drops in. Such is the price of three-wheel locomotion.

The actual price, however, is surprisingly reasonable: \$19,999 to start. That seems like a bargain for a machine that delivers so much visual impact and sheer visceral entertainment. Whatever the Slingshot is, there's nothing else like it.

### SLINGSHOT ANATOMY

**DRIVEBELT** The drivebelt is reinforced with carbon fiber to help withstand the Ecotec's 166 pound-feet of torque.

**ROLL HOOPS** Forged-aluminum roll hoops above each headrest help on the safety front, but a helmet is still a good idea.

**ENGINE** The General Motors Ecotec 2.4-liter four-cylinder makes 173 horsepower and previously served in the Saturn Sky and Pontiac Solstice.



**FRONT SUSPENSION** The front suspension is a double-wishbone setup with coil-over shocks.

**TRANSMISSION** The five-speed manual transmission is also from GM. No motorcycle-style sequential gearbox here.

### THE PETITION

#### Enough with the stop/start engines.



It's a great idea, in theory. Your engine shuts off at red lights, stop signs, and busy Taco Bell drive-throughs—whenever a momentary pause provides an opportunity to save some fuel. In practice, stop/start systems are annoying, pointless, and sometimes dangerous. Your car is barely using any fuel at idle anyway, and when it fires back up it's with a burp and a shudder, like someone startled grandpa during his nap. And that's if you're lucky enough that it actually restarts. We've had three cars from three different companies execute the stop part of the equation and then fail to restart. So on the plus side, you save a thimble of fuel. Downside: Enraged truckers slash your tires as your lane sits through two traffic-light cycles behind your wondrous miracle of efficiency. Fortunately, every car with stop/start comes with another feature: a button to turn it off.

PEOPLE WHO LIKE THIS STORY MIGHT ALSO LIKE:

[The Sun Plane, page 17](#) [Taking Things Apart, page 52](#) [Shelter, page 64](#)



## The Car of Trucks

GMC's new small truck is just big enough.

**N**OT EVERYBODY WANTS A full-size truck. There are people, believe it or not, who need a pickup but don't require 400 horsepower or 12,000 pounds of towing capacity. This fact is illustrated by the second-generation Toyota Tacoma, a 10-year-old design that nonetheless notches consistent six-figure annual sales, its only challenge coming from the equally ancient Nissan Frontier. The market is ripe for some fresh competition, and General Motors is bringing it with the 2015 GMC Canyon and its Chevy twin, the Colorado.

The Canyon is available with either a 2.5-liter, 200-horsepower four-cylinder or a 3.6-liter, 305-horsepower V-6. Just like the full-size trucks, there's an array of cabs and trims, from a manual-transmission two-wheel-drive work truck to a loaded 4x4 crew cab. The Canyon starts at \$21,880, including alloy wheels and backup camera, with prices nearing \$40,000 for a loaded SLT 4x4 crew cab. And maybe that sounds like a lot of dough for a midsize truck, but

with up to 7,000 pounds of towing capacity, the Canyon can lug as much as some full-size pickups. Its fuel economy, which ranges as high as twenty-seven miles per gallon highway with the four-cylinder, speaks to its lower weight and smaller footprint.

The Canyon also provides a polished driving experience, setting a new bar for truck refinement. The coil-over-shock front suspension delivers a composed ride, while triple-sealed doors ensure a hushed cabin. It's a very car-like experience, which isn't an accident—GM expects that many Canyon buyers may be moving on from a car.

And therein lies the appeal. The Canyon delivers the everyday virtues of a car, but it's still game to haul some mulch or tow a boat. For plenty of buyers, this will be all the truck they need.

### 2015 GMC CANYON

PRICE: \$21,880

AVAILABLE: NOW

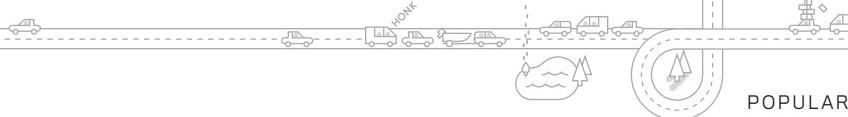
MPG: 18/26

### Why I Bought One: A Citizen Dispatch

**THE BUYER** Breck Owens, scientist, Woods Hole Oceanographic Institution

**THE VEHICLE**  
2015 GMC Canyon SLT 4x4

My wife and I are buying a Canyon to replace our 12-year-old GMC Sonoma. The Sonoma did a yeoman's work hauling brush and manure, but it only had rear jumpseats, which became a problem once we had grandkids. I wanted to stick with GMC, and the early Canyon reviews were positive. It's a lot bigger than the Sonoma—the rear bench in the crew cab we're buying has room for three car seats. We're going to drive cross-country this year, so we needed a vehicle that can handle Vermont in the winter and go out into the desert in California, with our bikes and gear in the bed. (We're also getting a tonneau bed cover for security and better gas mileage.) The navigation and driver-assist package will be put to good use on the trip. I didn't even consider a full-size truck.



### ARBITRARY OBSERVATION ON ELECTRIC VEHICLE PERFORMANCE

Phenomenal ————— Not bad ————— Eh  
 Tesla Model S                    BMW i3                    everything else



## Gloriously Impractical

Nobody truly needs a BMW X6. But plenty of people want one.

**T**HE ORIGINAL BMW X6, INTRODUCED IN 2008, was a shocking vehicle, a jacked-up four-door hatchback that created its own genre. BMW called it a sports activity coupe, which is as good a description as any. The second-generation car, new for 2015, hews to the same formula: more expensive and stylish than an X5, less practical.

BMW held the X6's international launch at its plant in Greer, South Carolina, which builds X6s for worldwide consumption. As such, the parking lot had plenty of forbidden foreign fruit, but I resisted temptation and drove the xDrive50i. With its two turbos, the 50i's 4.4-liter V-8 is good for 445 horsepower. A new rear-wheel-drive six-cylinder model will appeal to people who want an X6 but don't need four-season traction. The rear-wheel-drive model starts at \$60,550, with the all-wheel-drive V-8 beginning at \$73,850.

In keeping with those rather heady prices, the X6 puts on a good show inside and out. The xLine package covers nearly every interior surface with leather. The Bang & Olufsen stereo system looks as good as it sounds. Nineteen-inch wheels are standard, but the optional bigger wheels fully realize this car's Paris-to-Dakar-by-way-of-Rodeo-Drive aesthetic. Active cruise control works in stop-and-go traffic up to speeds of 130 miles per hour, where the X6 feels right at home. This is a heavy, Autobahn-crushing fortress of a machine.

No, the X6 still can't justify its existence by any rational measure. But the last one sold more than 260,000 units

worldwide and inspired copycats such as the Acura ZDX and the upcoming Mercedes-Benz GLE Coupe. Some of the most interesting cars don't fit into categories. They make their own.

#### 2015 BMW X6

PRICE: \$60,550

AVAILABLE: NOW

MPG: 19/27



## Gloriously Impractical

Nobody truly needs a BMW X6. But plenty of people want one.

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### Other Category-Defying Vehicles



**AMC EAGLE WAGON**  
A 4x4 station wagon, crude progenitor of the crossover.



**SUBARU LEGACY SUS**  
SUS stood for sport utility sedan.  
Sure, Subaru.



**CHEVROLET SSR**  
The first and still only hardtop convertible pickup truck.



**NISSAN MURANO CROSSCABRIOLET**  
A two-door ragtop-crossover. Dropped for 2015.

## A Discerning Man's Sport Sedan

The Acura TLX doesn't need to be flashy to be great.

**C**ONVENTIONAL WISDOM says that luxury cars need rear-wheel drive, as a matter of both performance credibility and styling. Acura understands this, but Honda's luxury brand sticks with front-drive platforms as part of its strategy, zigging when everyone else zags. Its new TLX has other tricks to win your attention.

The base 206-horsepower four-cylinder model, for instance, uses an eight-speed dual-clutch transmission that also incorporates a torque converter. This helps solve the riddle that plagues dual-clutch transmissions—indecisive low-speed behavior. A 290-horsepower V-6 is optional, and all V-6 models are available with all-wheel drive.

Acura's aptly named Super-Handling All-Wheel Drive provides torque vectoring at the rear wheels. This gives the all-wheel-drive cars fantastic agility by overdriving the outside rear wheel in corners. Four-wheel-drive models get Precision All-Wheel Steer, a new system that steers the rear wheels independently, improving cornering and aiding stability at high speeds or when under braking.

**More tricks:** Active engine mounts reduce vibration. Acoustic foam kills noise. And every model gets full LED headlights—unheard of for a car that starts at \$31,915.

Overall, the TLX comes across as the ultimate Honda. And that's a compliment.

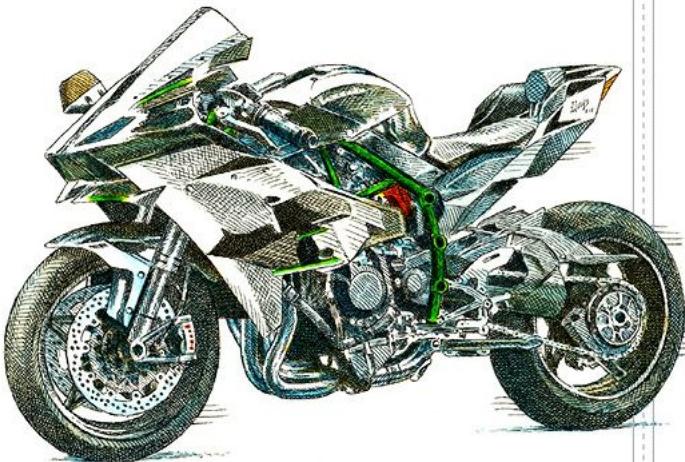
#### 2015 ACURA TLX

PRICE: \$31,915

AVAILABLE: NOW

MPG: 24/35

## The Motorcycle, Three Ways All of them fast.



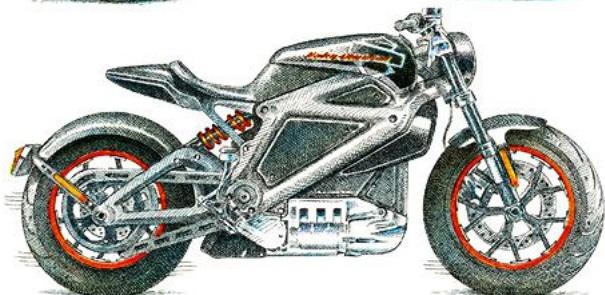
**The Rule Breaker**  
**2015 KAWASAKI NINJA H2R**

**PREVIEW** There's a gentlemen's agreement among motorcycle manufacturers: In the name of sanity, nobody strays above 200 horsepower or a 187-mile-per-hour top speed. At least that was the case until Kawasaki decided to ignore rules, moderation, and possibly a few laws of physics. The result is the Ninja H2R (base price: \$50,345), a track-only bullet bike that takes two-wheeled performance to a scary new place. The key ingredient is the motor, a supercharged 1.4-liter four-cylinder that revs to 14,000 revolutions per minute and generates 300 horsepower. The supercharger is a new planetary gear design created with help from Kawasaki's gas-turbine division, because existing suppliers didn't have a blower that could handle an internal speed of 130,000 revolutions per minute. The bike's carbon-fiber bodywork uses front spars that look borrowed from a Formula One car, providing downforce that riders will appreciate when nearing the H2R's top speed—over 200 miles per hour. The H2R isn't street legal, but Kawasaki knows it can't prevent customers from adding, say, lights and Department of Transportation-compliant tires. This is one case where a license plate might be the wildest modification of all.



**The Deceiver**  
**2015 INDIAN SCOUT**

**TESTED** The Scout (top) looks like a laid-back cruiser, but its classic styling conceals modern, high-performance technology, courtesy of a new fuel-injected, liquid-cooled V-twin that kicks out a hundred horsepower and seventy-two pound-feet of torque. Dual overhead cams and four valves per cylinder give the Scout (base price: \$10,999) big lungs at high revolutions per minute, while good old-fashioned displacement—1,133 cubic centimeters of it—provides plenty of torque. With an aluminum frame helping keep weight down to 558 pounds, the Scout has a better power-to-weight ratio than a Porsche 911 Turbo. So while it's happy to putter around town looking good, it can still boogie when it wants to.



**The Screamer**  
**HARLEY-DAVIDSON PROJECT LIVEWIRE**

**TESTED** Is a Harley still a Harley without the rumble? That's the question behind Project LiveWire, an all-electric concept Harley built more than twenty examples of to gauge public interest. So far, feedback is pointing toward the green light for production. With instant torque and no shifting, the bike screams off the line. Harley estimates a zero-to-sixty time of four seconds and a range of fifty-three miles. Weighing just 463 pounds, LiveWire is agile and extremely quick around town. And while there's no rumble, intentionally noisy straight-cut gears mean that accelerating toward the ninety-two-mile-per-hour top speed produces the keening cry of a spacecraft going into warp drive.

### This Month in Lifesaving Technology

EVERYONE DUMPS HIS BIKE. It's basically a rite of passage. And let's not forget about the dangers that come from distracted drivers. So having the best safety gear is crucial. That's why we like Spidi's new Neck DPS Airbag Tex Vest (\$600). Light, and loose enough to fit over your own riding gear, the vest uses a CO<sub>2</sub> cartridge connected to a tether attached to your bike. If you fall off the bike, the tether snaps free from the cartridge, inflating two sturdy airbags around your neck. You won't want to leave your bike without it.



#### IPAD EXCLUSIVE

Check out the Popular Mechanics mobile edition to watch assistant editor Kevin Dupzyk test Spidi's inflatable Tex Vest.

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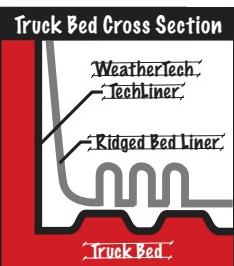


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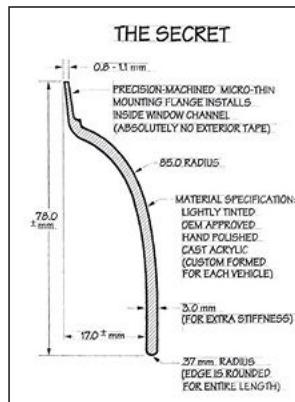
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# A BEAUTIFUL THING

The Maple Heart Longboard





**Y**OU COULD CALL WARREN PIECES a carpentry company that happens to make skateboards as easily as you could call it a skateboard company that also takes on big carpentry projects. The same goes for the owners, Whitney Phillips and Matt Groom.

Both grew up in Vermont and were participants in the region's action-sports scene, spending the school years at a ski academy and banging nails on construction jobs during the summers to pay for their winter lift tickets. After each served a few years in corporate jobs, they both came home, got back into woodworking, and, in 2011, Groom hired Phillips to restore the intricate shelving of a wine cellar destroyed by Hurricane Irene. They couldn't believe the amount of leftover fine hardwood scraps that were destined for the incinerator after projects, so they started collecting the spare pieces of walnut, oak, maple, and cherry—much of it native—and hauling them back to their workshop in Warren, Vermont. With a lull between jobs, and Whitney's son's birthday

coming up, the two set to making the kid a skateboard with the stockpile of scrapped wood. Their two worlds—wood and action sports—fused.

They've been making skateboards, longboards included, ever since. They've discovered along the way that the type of wood they use, its thickness, and the orientation of the grain in the veneers they lay over the bamboo bases impact a ride as much as they do the board's look. For instance, harder woods lend themselves to a stiffer board, whereas you get a smooth, surfboard-like feel with relatively softer walnut. Mistakes made on one board inform improvements to the next—Matt or Whitney or one of their employees tests each deck on beer and food runs from the studio to the center of town. In this way, they've perfected their own brand of skateboard and, with their mashup of extreme-sport passion and colonial-style craftsmanship, tapped into something uniquely Vermont. —MATT GOULET

---

**COMPANY:** Warren Pieces

---

**LOCATION:** Warren, Vermont

---

**OWNERS:** Whitney Phillips and Matt Groom

**IN THE SHOP**



After lining up and gluing together layers of fine wood such as maple, walnut, and mahogany, Groom (left) and Phillips rip a board lengthwise through its middle, creating two thin pieces that when assembled side by side give the finished decks their symmetrical look.

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# SKILLS

## HACK YOUR COFFEE

Forget latte art. Brewing coffee is science.  
BY FRANCINE MAROUKIAN

**DESPITE WHAT SOME BARISTAS WANT YOU TO BELIEVE,** making coffee is not an art. It's a mechanical process more akin to culinary science, in which an ingredient is acted upon in ways proved to produce the best-tasting, repeatable results. As master roaster and resident palate at La Colombe Torrefaction, the revered Philadelphia-based coffee company, Jean Philippe Iberti takes a gastronomic approach. "I treat it like spiced water," he says. "Coffee beans and spices—which are extracted from bark, roots, seeds, buds, and hard berries—are grown in similar climates, and both require the application of controlled heat to release their essential oils and unlock their endlessly variable flavors."

Although specifics vary with preparation method, Iberti explains here the principles for the classic French press, a laboratorial glass beaker with a plunger lid set in a stainless-steel casement with Bakelite handles, the style



# SKILLS

## COFFEE

popularized in Parisian cafés during the mid-fifties. As with most culinary endeavors, practice plays an integral part in the success of your final product. "Making coffee is a personal ritual," Iberti says. "There's always a range within each step, a give-and-take in the process as you experiment to find your own taste." Make coffee often enough—say, every morning and twice on Sundays—and your senses will eventually take over: At some point, you'll be able to tell from the aroma and color when it's done, producing café-quality results at home—minus the waiting in line and all that attitude behind the counter.

### How to Make Coffee in a French Press →



Coffee architects: La Colombe Torrefaction's Jean Philippe Iberti (left) and brew crew member Caleb Lewis.

**IF YOU'RE STILL USING A MR. COFFEE** Run one brew cycle with just water—no coffee—to saturate the filter. This will remove the filter's papery taste, as well as eliminate surface irregularities and dry spots, allowing the brewing water to soak the grounds more evenly. Now run a second brew cycle with the coffee.

### The Temperature



Bring the water to a boil, 212 degrees Fahrenheit, then remove it from the heat and let it sit for thirty seconds so that it falls into the 200 F to 208 F range. Any higher and the heat will draw unwanted elements out of the grounds, giving your coffee a slightly bitter flavor and a silty quality that coats the tongue. You can insert any digital-probe thermometer to check for this, but if you want perfect accuracy, try the Bonavita Variable Temperature Digital Electric Gooseneck Kettle. Its temperature increments—every degree between 140 F and 212 F—allow for near-pathological levels of control.

### The Water



"Although I have respect for the coffee/water ratio, when it comes to making coffee in the morning I am more caveman than scientist. I eyeball it, adding ground coffee to the beaker so it looks like one part coffee to six parts water volumetrically," Iberti says. Dissolved solids from coffee make up only 1.2 to 1.4 percent of the final beverage, so what kind of water you use is important as well. Iberti's choice: bottled spring.

### The Grind



Fine grounds have more surface area and will release flavor more quickly than coarse grounds, so if you want uniform extraction, you need uniform particle size. (Imagine cutting a raw steak into uneven pieces and then cooking them all for the same length

of time—no good.) To achieve uniformity, use a conical burr grinder instead of a blade grinder. The chop-chop-chop of a blade grinder is like hitting the beans with a machete, and the heat from the motor can activate the coffee's essential oils, producing wildly uneven results. A conical burr grinder, on the other hand, pulverizes the beans between two abrasive surfaces, allowing for more consistency. The Hario Skerton grinder does this simply, with a hand crank. Aficionados might try the motorized Baratza Virtuoso, which has a burr mounting system that can produce uniform particles in 40 sizes.

### The Pour



A French press is the only coffee-maker in which you can actually see the water acting as a solvent on the coffee. On first pour, cover the grounds by just an inch of water. This is called the bloom—when gases rise, the top foams, and aromas are created. After adding the remaining water, stir once or twice with a long spoon to break the top foam and create a homogeneous suspension of the grounds in the water; this is called a slurry. Now put on the lid.

### The Timing



Lid on, Iberti lets his coffee steep for just one more minute. "Let coffee sit too long and it develops flavors you don't want, like too much char on a steak," he says. This is why you should never keep your coffee in a French press after you've pressed out the grounds, as it will continue to brew. When it's ready, decant your coffee into a serving vessel.

### ONE MORE THING . . .

If you like your coffee with milk, fill a clean French press about one-third of the way with warm milk. Slowly insert the plunger and pump it (like a bike-tire pump) until the milk foams and expands to twice its volume. The milk will be silky, frothy, and ready to pour into a café au lait.

# THE NEW OLD TAPE MEASURE

What the heck is a story pole?

BY DAVID OWEN

**A** COUPLE OF YEARS AFTER my wife and I bought our house, I gutted an unused room and turned it into an office. The project was highly educational, in the sense that by the time it was finished I possessed many skills I ought to have had before I began. Even so, the office turned out pretty well, and in the course of building it I became the owner of virtually every kind of power tool.

I also acquired quite a few analog tools—including story poles, which I'd learned about from a carpenter friend. A story pole is a homemade measuring rod on which the only markings are ones you make yourself, specifically for the job at hand. For many projects a story pole is easier to manipulate than a tape or a fold-up ruler, and because it contains no extraneous information it acts as a check against careless errors.

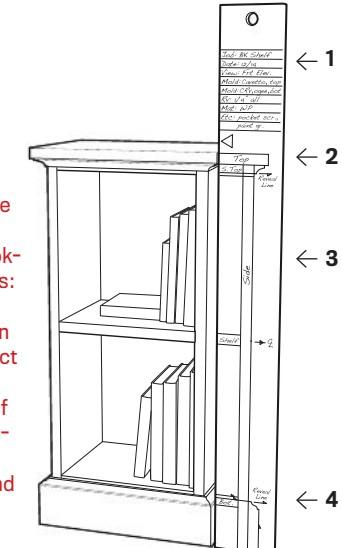
To create mine, I squared off the ends of several long pieces of 1 x 2-inch pine, then marked each one with labeled lines representing the critical dimensions of the cabinetry I was planning to build and install in the office: lengths, widths, depths, spacings. Once I'd done that, I didn't need to remember that the bookcases on the north wall were going to be 11½ inches deep; I just had to find the depth line on my north-bookcase story pole, then transfer that mark to a sheet of plywood and make my cuts. I also never had to rest an elbow on my tape measure to keep it from whipping back into itself as I groped for a pencil. A story pole is rigid, and if you need both hands you can clamp or tack it in place.

Story poles, in one form or another, have helped builders of all kinds for aeons. Ancient Egyptians used them in constructing the pyramids. Eighteenth-century house framers used them to keep track of ceiling-joist heights (hence the name). Masons, shinglers, and siding installers still



use them to maintain the spacing of their courses. Electricians use them to position outlets, fixtures, and switches. My house is so old that it contains almost no level surfaces or right angles; to orient my office bookcases, cabinets, and desk, I used a spirit level to draw a reference line on the Sheetrock at countertop height all the way around the room, like an artificial horizon, then used a story pole to position elements above and below it. I've even used a story pole to hang pictures.

Story poles are easy to make, but if you prefer tape measures, compromises are available. Lee Valley, a woodworking supply company, sells blank tape measures called Precision Story Tapes: You can make your own marks on them with an indelible pen and end up with a permanent dimensional record of each job. FastCap, another woodworking supplier, sells hybrid tapes that have conventional English or metric markings on one edge but give you a strip of white space on the other for erasable pencil notations of your own. Each FastCap tape measure even has a built-in pencil sharpener—a feature still missing from the rest of my high-tech tools.



**Every story pole** is a map. This one is for a bookcase. It includes: a data block (1), the location of the bookshelf top (2), information about the body (3), and the bookshelf base detail (4).

## A THING YOU SHOULD KNOW

### HOW TO TRANSMIT THE INTERNET THROUGH OUTLETS

Even if your Internet came into your home at the speed of light, your Wi-Fi network would still create a choke point when everyone in the family is online simulta-

neously. To solve this, you can bypass Wi-Fi entirely and use your electrical wiring like an enormous Ethernet cable. You'll need a pair of power-line adapters.

D-Link and Netgear sets cost about \$50. One adapter plugs in to your router and a wall socket; the other plugs in to a socket and the device. This creates a new,

unshared data channel for each Internet-enabled item, which means you'll have only one thing to blame for losing in Call of Duty: your aim.

—CAMERON JOHNSON

# SKILLS

HOW TO

## THE ART OF THE LOOP

A simple guide to a complicated thing: layering instruments and sounds over each other to create music. **BY KAWEHI**

**'VE ALWAYS BEEN MUSICAL.** My grandpa even had a nickname for me as a kid: *lekiō*. It means radio in Hawaiian. At first it was keyboards. I always joke that, as an Asian kid raised by Asian parents, it was either violin or piano, and piano was less boring to me. I started writing music soon after, and eventually I picked up guitar. I moved to Los Angeles to be a singer-songwriter, but I was like every other female musician with an acoustic guitar. I wanted to do something different, so I learned to loop.

My first looper was a tiny two-track called the Boss RC-30. I went into the garage to learn how to use it, and I sucked. My timing was terrible. That's the most important part of looping. If one thing is off, everything is off, and you're left with a big pile of noise. But by the end of the week I had my timing down. From there, I was addicted.

You need a speaker, a mic, and a loop station, a machine that records sounds, which you can vary in pitch and tempo and play back through an assortment of effects. A two-track loop station (they go up to five) like the RC-30, which'll cost you \$300, is good for beginners. Tracks are different sections, A and B, you can record. You switch between them using a pedal. I always set the verse as A and the chorus as B.

Drums are really the foundation. You could use the real instruments, but a keyboard is the easiest route. Or you could even try beatboxing. After I layer the drums, I put on bass—one layer for the chorus and a different one for the verse. With those elements, you have a foundation for the entire song. From there you can play along with a guitar or sing.

**OUR EXPERT**

Kawehi (no last name, just Kawehi) is a bit of a phenomenon. Her YouTube videos—in which she uses nothing other than her voice, occasionally a guitar, and a looping machine to record covers and original music—have been viewed millions of times each. You can find out about upcoming shows, support her next album, or just check out some songs (her cover of Britney Spears's "Criminal" is a good tutorial in building a track) at [kawehi.com](http://kawehi.com).



**TIP!**

There is a metronome built into many loopers that helps you keep time. Use it. Timing is the most important thing about looping. One millisecond off and you're starting over.

PROMOTION

Popular Mechanics

# WORK SHOP

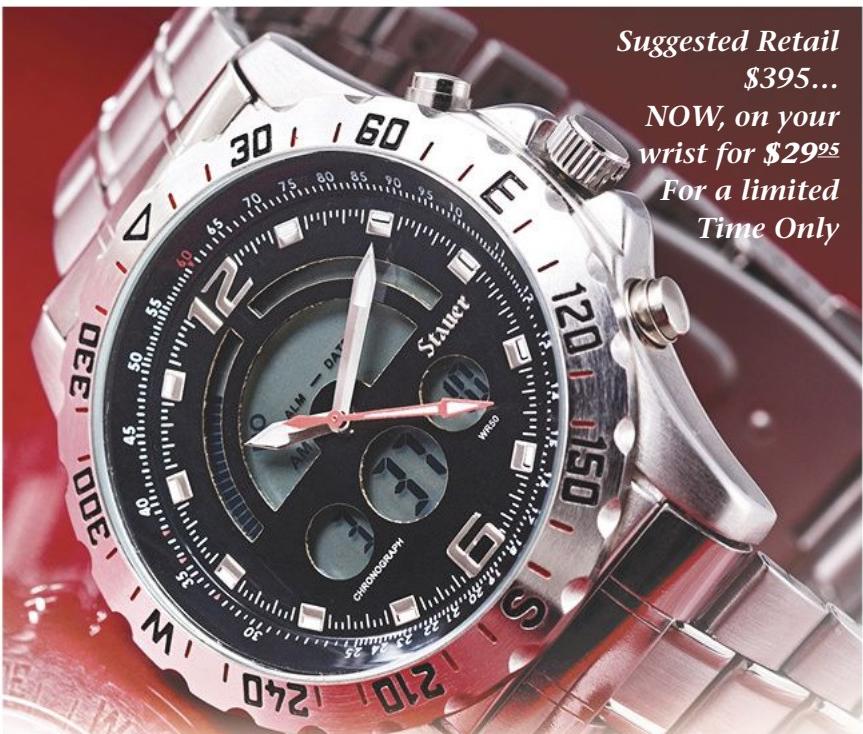
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## Amazing New Hybrid Runs Without Gas

*The new face of time? Stauer's Compendium Hybrid fuses form and functionality for **UNDER \$30!** Read on...*

Innovation is the path to the future. Stauer takes that seriously. That's why we developed the **Compendium Hybrid**, a stunningly-designed hybrid chronograph with over one dozen analog and digital functions that is more versatile than any watch that we have ever engineered.

We originally priced the Stauer **Compendium Hybrid** at \$395 based on the market for advanced sports watches... but then stopped ourselves. Since this is no ordinary economy, we decided to start at **92% off** from day one. That means this new technological marvel can be yours for only \$29<sup>95</sup>!

**Welcome a new Digital Revolution.** The watch's extraordinary dial seamlessly blends an analog watch face with a stylish digital display. Three super-bright luminous hands keep time along the inner dial, while a trio of circular LCD windows track the hour, minutes and seconds. An eye-catching digital semi-circle animates in time with the second hand and shows the day of the week. The watch also features a rotating bezel, stopwatch and alarm functions and blue, electro-luminescence backlight. The **Compendium Hybrid** secures with a rugged stainless

steel band and is water-resistant to 3 ATM. Fits a 6 3/4"-8 3/4" wrist. Includes 2 year warranty on movement.

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# SKILLS

## AUTOMOTIVE



John Kempf, a Freedom High junior and auto club member, uses a linear motion to sand body filler.

## THE KIDS IN THE GARAGE

How to strip, repair, repaint, and rewire an old car—with help from an after-school auto club. Part two of a six-month series.

**THE STUDENTS WE INTRODUCED LAST MONTH** from Freedom High School's auto club in Freedom, Wisconsin, are still hard at work on their project cars, a 1974 Oldsmobile Delta 88 and a 1981 Chevrolet Camaro Z28. They've finished stripping the paint and moved on to the next stage in the restoration project: metal repair. Both cars had panels with enough rust and metal damage that they needed to be patched or entirely replaced—by welding and using plasma cutters, much to the students' enjoyment. But many of the panels had dents the club could fix just with body filler. "My favorite part is the bodywork," says Cole Woods, a 16-year-old junior who owns the Oldsmobile project car. "I like seeing the progress of an old car from rusty to shiny-new." It's especially rewarding when the car that's being transformed is your own.

### → HOW TO FILL A DENT

Tips from the Freedom High School Automotive Program.

Regardless of a car's age, if a dent is less than a quarter-inch deep, it's fine to use body filler. If the dent is deeper, the metal must be straightened first, or you run an increased risk of the filler cracking, chipping, or adhering poorly.



#### STEP ONE

#### PREP THE DENT

Before you start, clean the damaged area with a preparation solvent, such as Pro/Base Low VOC Surface Cleaner. Use a swiping motion to keep from spreading contaminants. Then, if applying the filler to a car with paint, use 80-grit sandpaper to sand the surface down to the primer. If working on bare metal, abrade the metal enough to show small scratches. These will help the filler stick.



#### STEP THREE

#### SAND

Using 80-grit sandpaper, cross-sand the filler until it is level with the rest of the surface metal. Then, using 180- or 320-grit sandpaper, continue to cross-sand the area until the edges are feathered—thoroughly blended into the surrounding metal. The deeper scratches from the coarser sandpaper will help hold your first coat of primer.



#### STEP TWO

#### FILL THE DENT

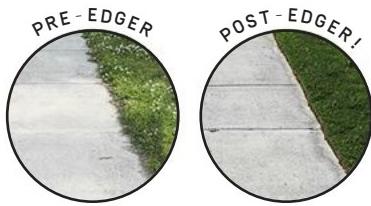
Use a paint stick to place the amount of filler you need on a mixing board. Carefully fold in the

### → NEXT MONTH

#### BODY SANDING AND PRIMING

#### ILL ADVISED FILLING MATERIALS THE FREEDOM AUTO CLUB HAS FOUND IN OLD CARS:

newspaper • crate foam • fiberglass • aluminum cans • a cardboard beer case • parts of a screen door



## THE INDEFATIGABLE EDGER

Unruly lawns, beware. **BY ROY BERENDSOHN**

**LIKE A FRAME ON A POSTER OR A BEARD ON A TEENAGER,** an orderly lawn matures a house, making it look complete, self-assured, put together. You don't need to hire a landscaping service to have a lawn like this, but you do need a quality edger, the kind that can cut an arrow-straight notch time after time without tiring you out. To find such a tool, we gathered five and put them to work on acres of grass along hundreds of yards of pavement. We emerged covered in dirt and clippings, but we found a few favorites. And you should see the lawn.

### ★★★★★ ARIENS 986103 \$420

**Engine:** 136-cc

**Depth settings:** Four

**Angle settings:** Seven

**Likes:** This well-designed machine easily took first place. Its solid construction virtually eliminates vibration, even on deep cuts. Its 21-

inch wheelbase (2 to 7 inches longer than other machines') improves its accuracy on long, straight runs.

**Dislikes:** The graphics for the throttle lever and the start/run lever are difficult to read.



### ★★★★★ HUSQVARNA LE475

\$540



**Engine:** 127-cc

**Depth settings:** Eight

**Angle settings:** Five

**Likes:** Solid and smooth-cutting, even when plowing a deep trench. It could serve both residential and commercial customers without ever wearing out.

**Dislikes:** The graphics for the choke and gas-shutoff levers are somewhat illegible.

### ★★★★★ POWERMATE PWLE0799.1

\$250



**Engine:** 79-cc

**Depth settings:** Five

**Angle settings:** Three

**Likes:** The three-edge blade provides a good cut, and the simple start sequence is gold: Just choke the engine and pull the recoil start cord.

**Dislikes:** It could use more power for deep cuts. And the blade begins turning when the engine catches.

### ★★★★★ CRAFTSMAN 247.762461

\$300



**Engine:** 140-cc

**Depth settings:** Five

**Angle settings:** Three

**Likes:** This great little edger couldn't be simpler to start (push the primer bulb and pull the rope). To store the machine, fold the handle forward. There. Done.

**Dislikes:** Its blade begins turning when the engine starts, which is a little dangerous.

### ★★★ YARD MACHINES 52J

\$300



**Engine:** 140-cc

**Depth settings:** Five

**Angle settings:** One

**Likes:** Gas-engine edgers don't come any simpler or more compact than this. When you're done, fold the loop handle forward to store it. The whole edger will fit in the trunk.

**Dislikes:** Once again, the blade turns as soon as the engine starts. Safety first, guys.

# SKILLS



## ASK ROY

Popular Mechanics' senior home editor solves your most pressing problems. **BY ROY BERENDSOHN**

If I'm not there to remind him, my son won't wear his safety glasses when working in our garage shop. I've tried both bribes and punishment. I even showed him a picture of an eye injury I found on the Web. Nothing works. He says he just forgets. Any ideas?

Behavior modification isn't my strong suit, but I think I can help: First, make sure your son's glasses are comfortable and fit him well. You might even take him to the store and let him pick out a pair he likes. If fit isn't an issue, maybe his glasses fog easily. You could buy a fog-resistant model such as those made by Honeywell Uvex. You could also treat the glasses with Clarity Defog It, a rub-on liquid that leaves behind a film.

Then, of course, there's the cool factor. You may just have a stubborn, budding fashion lover on your hands. And I know just the thing for him:

The old-school safety glasses I grew up with have begun reappearing lately in fancy home-improvement catalogs and Web stores. The new ones have a dash of steampunk geekiness that the kids seem to like, but they are absurdly expensive. Instead, you can buy original horn-rim safety glasses with wire-cup side shields from Universal Industrial Supply. Two pairs cost \$24, which is much cheaper than eye surgery.

I seem to have caulked the kitchen-counter backsplash poorly. Less than a year later, some of the caulk is peeling away. What did I do wrong?

Probably several things. First, caulk, glue, and paint have one thing in common: They stick best to a clean, dry surface. In the kitchen you need to clean with a degreaser, such as Krud Kutter, before applying caulk.

You may also have chosen the wrong product. Caulk comes in any number of formulations. In your case, you should have used a high-quality caulk labeled for kitchen and bath. And you should have made sure it stayed dry as it cured. The manufacturer specifies the necessary time, but it's typically about three hours.

Since you'll be recaulking anyway, here's how to do it neatly: Cut away the old caulk with a utility knife and a brand-new blade. Use a painter's tool (a putty knife with a hook-shaped blade) to rake out any remaining caulk. Next, snip the end of the caulk tube so it produces as small an opening as possible that will let a thin but steady stream of caulk through, no larger than about  $\frac{3}{16}$ -inch diameter. Place the tube in a contractor-grade caulk gun, which you can buy for about \$20, and apply the caulk in as straight a line as possible.

Send your toughest house and yard questions to AskRoy@popularmechanics.com.

We have a prefabricated wood-frame garage sitting on gravel. Its sill plate has completely rotted away, and it has some rotted siding. Should we repair this, or is the garage a goner?

Fixing this is going to be a big, back-breaking job. It's probably easier to tear down the garage and build a new one with a pressure-treated sill plate.

If you're not ready to rebuild just yet, you can extend the life of your current structure for up to five years by adding additional support. Position a 2 x 8 horizontally against each solid wall, at least 3 inches above the garage floor. These should be as long as the wall itself. Using hot-dipped galvanized lag screws, fasten each board to the studs, making sure you're sinking into solid, rot-free wood. As you add screws across the face of the board, make as much of a zigzag pattern as you can. This will create additional stability.

After the snow melts, my lawn looks terrible until about the middle of June. Please help.

Sorry to be the one to tell you this, but it sounds like you blew it for this year. The way to get a lawn to bounce back in the spring is to fertilize it in the fall. Fertilizers for this purpose are labeled fall fertilizer or winterizer. The nitrogen in these fertilizers helps the grass store carbohydrates so that it will grow quickly when the sun returns. The potassium improves the grass's resistance to cold. Turf pros call this cold hardiness. You can drop that phrase at your next cocktail party.

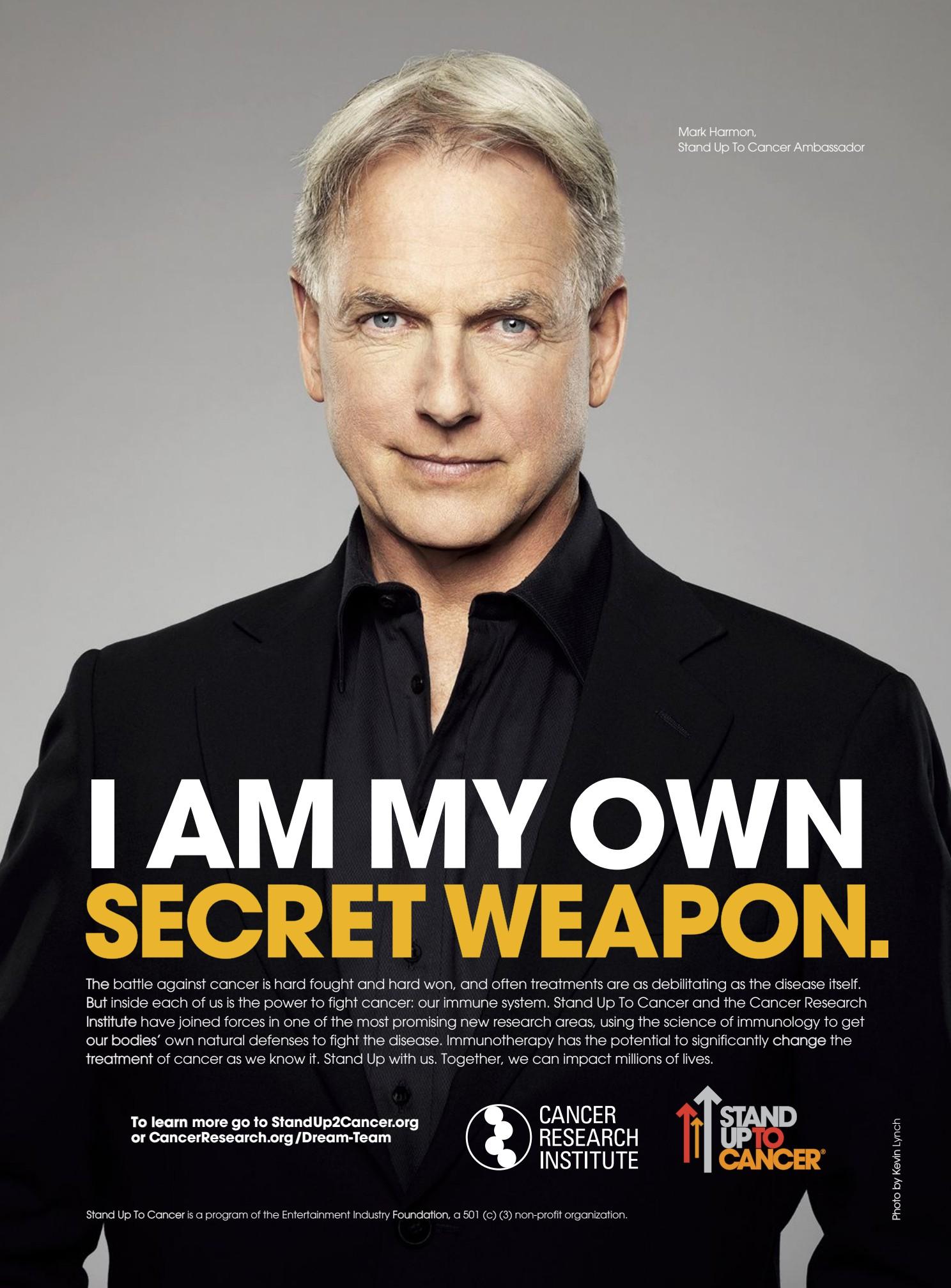
Now for the good news: You still have time to apply a spring fertilizer or a combination fertilizer with pre-emergent herbicide, such as a Scotts Turf Builder. It could gain you a few weeks of nice grass, at least.



WHAT'S IN  
ROY'S  
GARAGE?

Our columnist on his favorite new tool.

What's great about buying a saw from a legacy tool company like Skil is that you know what you're getting—a sturdy, comfortable tool from a company that's proved itself for more than ninety years. So it is not surprising that Skil's newest circular saw, the SPT67WM-22, is solid, agile, and vibration-free, with a sidewinder construction and a magnesium motor housing and shoe. It's more surprising that it has a heck of a lot of new design flourishes, including industrial-looking motor vents and ribbing reminiscent of the company's flagship, the Model 77, which was introduced back in the 1930s. It's never a good idea to sacrifice substance for style, but in this case, you can have both.

A professional headshot of actor Mark Harmon. He has short, light-colored hair and is wearing a dark, button-down shirt under a black blazer. He is looking directly at the camera with a slight smile.

Mark Harmon,  
Stand Up To Cancer Ambassador

# I AM MY OWN SECRET WEAPON.

The battle against cancer is hard fought and hard won, and often treatments are as debilitating as the disease itself. But inside each of us is the power to fight cancer: our immune system. Stand Up To Cancer and the Cancer Research Institute have joined forces in one of the most promising new research areas, using the science of immunology to get our bodies' own natural defenses to fight the disease. Immunotherapy has the potential to significantly change the treatment of cancer as we know it. Stand Up with us. Together, we can impact millions of lives.

To learn more go to [StandUp2Cancer.org](http://StandUp2Cancer.org)  
or [CancerResearch.org /Dream-Team](http://CancerResearch.org/Dream-Team)



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Stand Up To Cancer is a program of the Entertainment Industry Foundation, a 501 (c) (3) non-profit organization.

# SKILLS

TAKING THINGS APART

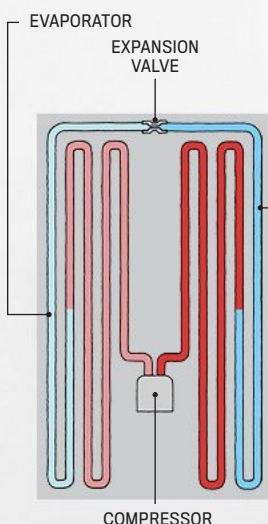
## ALL THE STUFF THAT MAKES STUFF COLD

A lesson in fridge anatomy.

BY ROY BERENDSOHN

### A REFRIGERATOR IS AN UNNATURAL THING:

a box of cold air made up of components that use electricity (hot) to move heat (also hot). If you sit next to one on a quiet day, you can hear the appliance paradoxically working—the whispery trickle of refrigerant boiling in the evaporator coil. Looking at this literal black box, you might be inclined to tear it to pieces looking for answers. But you won't have to, because repairclinic.com technician Chris Zeisler helped us do it for you. He disassembled a standard Whirlpool side-by-side refrigerator-freezer with door-front water and ice dispenser. He found dozens of parts. None of which, it turns out, is particularly mysterious.



### YES, BUT HOW DOES IT WORK?

If you want to make a hot space cold, you need to carry heat energy away from it. To do this, a refrigerator uses a chemical called a refrigerant inside a length of sealed tubing. This refrigerant absorbs heat from the freezer in a portion of the tube called the evaporator coil. It then moves to the compressor and then to the condenser coil at the bottom or back of the refrigerator and releases that heat into the air.



In 25 years,  
repairclinic.com's  
Chris Zeisler has  
never faced an  
appliance problem  
he couldn't fix.



**1. Evaporator:** Turns liquid refrigerant into vapor, allowing it to absorb heat from the air in the freezer compartment.

**2. Compressor:** Compresses refrigerant vapor.

**3. Condenser:** Receives compressed refrigerant vapor, condensing it into liquid, releasing its heat to the surrounding air.

**4. Water filter:** Removes impurities from water for ice or chilled water.

**5. Water-inlet valve:** Controls water flow to the icemaker and chilled-water dispenser.

**6. Defrost control board:** Regulates the defrost cycle to melt ice that accumulates around the evaporator

in the freezer.

**7. Air damper:** Shutters on the damper control the airflow from the freezer compartment to the fresh-food compartment.

**8. Condenser fan:** Blows air over the compressor and the condenser coil, cooling the compressor and increasing the coil's ability to release heat.

**9. Dispenser push-button switch:** Controls on/off function for dispensing ice and chilled water.

**10. Auger-drive motor:** Powers the auger that turns ice out of the bucket, forcing it down the dispenser chute.

**11. Air-damper control and thermostat:** The two parts

work together to control airflow from the freezer to the fresh-food compartment. The damper control (on the right) and the thermostat (on the left) allow the refrigerator to respond automatically to a temperature that you set manually.

**12. Evaporator fan:** Blows air over the evaporator coils, increasing their heat-absorbing capability.

**13. Ice-crusher solenoid:** An electromagnetic coil that controls the ice crusher.

**14. Run capacitor:** Energizes compressor-motor winding to provide a rotating magnetic field within the motor.

**15. Water line:** Carries water

from the water valve to the icemaker in the freezer.

**16. Ice-crusher plunger:** Pulled in by the ice-crusher solenoid, the plunger assists in dispensing crushed or cubed ice.

**17. Defrost heater element:** A resistance heater that melts the ice that forms from frozen condensation on the evaporator coil.

**18. Water-line connector:** A fitting that connects water lines within the refrigerator.

**19. Dispenser microswitch:** Energizes or de-energizes the chilled-water or ice-dispensing circuit.

**20. Crushing blade:** Crushes ice.

POPULAR MECHANICS • 02.15  
**THE  
CASUAL  
MAN'S  
GUIDE  
TO**  
↓

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**DISASTER  
LEVEL:**

 **STABLE**  
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 **WORSENING**  
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 **APOCALYPTIC**  
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**HARD-CORE TIPS, PREPARATORY ADVICE, AND ILLUMINATING INSIGHTS  
FOR THE SOMEWHAT CONCERNED.**

PHOTOGRAPHS BY IAN ALLEN • TYPOGRAPHY BY ISTVÁN SZUGYICZKY



EXPERT

# NATE BECKER

DOG Musher, Eagle, Alaska

After spending his twenties and early thirties as a firefighter and paramedic in Wyoming and, later, for the National Park Service in the Grand Canyon, Becker moved to Eagle—a town with a population of 86—in 2008 to lead dog-sledding trips in the backcountry with Bush Alaska Expeditions. Here, he shares his survival rules.





↑

**On the trail**  
Becker prefers to wear gloves under his mittens, because "you can take a gloved hand out of a mitt and do something like chop wood or set a trap."

### GEAR

Always take a sleeping bag. You never know when you'll get stuck out and have to spend the night or just need a quick warm-up. And I bring a preassembled emergency pack. Right on top is a pair of warm mitts in a ziplock bag. History is riddled with stories of people who didn't survive because their hands froze. You can walk a thousand miles on frozen feet, but you can't survive six hours with frozen hands.

Also in my pack are blankets, hand warmers, a big survival knife, signaling devices, fire-starting equipment—you can't have enough fire starter. One thing I absolutely won't be without is a Leatherman. I carry two. And then there's a fur ruff, which lines the hood of your parka. Even the stiffest wind has a hard time penetrating a ruff. Just make sure it's real fur.

### TRAVEL

The easiest travel is on frozen rivers and creeks, because the land is usually choked with brush and trees. But remember that the ice is dangerous. You have to know the difference between good ice and bad. Clear is bad. You want cloudy.

And you want cracks. Once ice gets thick, the water expands as it freezes. It has to give somewhere, so the ice cracks. When you see cracks in cloudy ice, it's almost always safe.

### SETTING UP CAMP

For me the number one priority is easy water. You can almost always find enough firewood. But it takes a lot of time and energy to melt enough snow into water for twenty dogs. To find the water, just listen for it. When I get to a spot that looks like it might have water, I'll put my ear down and listen. If I can hear the water, I can get to it. If I can't hear it—because it's under a few feet of snow and another foot of ice—I move on.

If it's a true emergency, don't worry about trying to build the shelters you see in survival books. You would never have time to build most of them. As long as you've got a sleeping bag, the best and the quickest shelter you could make would be to sandwich yourself with your sleeping bag inside a tarp, kinda like a burrito, and then figure out some way to cover yourself with snow for insulation. When it's 60 below and the snow

temperature is only minus 20, that 40 degrees makes a difference.

### TRAPPING

If you can, set traps every quarter-mile to half-mile. Up here in Alaska, a lot of us catch marten using small leg-hold traps, which are those spring-loaded metal jaws. To set the trap up, first find a ten-foot, small-diameter spruce tree, preferably a dead one. Then tie it to a big tree at a 45-degree angle from the ground. On the end of that pole you hang bait or a lure or both. A lot of times we'll use a visual attractor like a feather or something shiny. Bait can be guts from other animals or even a piece of hide. Once you secure the trap to the spruce tree just in front of the bait, open it. The idea is to get the marten to climb the pole and step in the trap.

### STAYING DRY

Don't work up a sweat. If I find myself exerting a lot of energy, the first things off are my hat and neck gaiter to promote cooling. It is far better to stay a little chilly (knowing I can put clothes back on to warm up) than to let yourself perspire. Moisture lessens the insulating value of your gear, and even the best moisture-wicking fabric in the world won't eliminate sweat. Once you get wet, you stay wet until you get to the cabin or tent at night to dry out.

### RESCUE

I always carry high-visibility material in neon orange or green. This comes from my days working on a helicopter crew as a paramedic. It's easy to miss someone from the air, so you want to make yourself as visible as possible. That means movement and contrast. A signal flare works, obviously. But neon material called flagging can be tied to a tree. Then, if a pilot flies over, he can see you and which way the wind is blowing. That helps him if he's going to come in and land to get you out.

*—as told to Peter Martin*

### PREPPER JARGON DECODER

**BOB:** Bug-out bag. The essential escape kit in case of emergency. → **GENNY:** Generator.

# PREPPING LITE

What preppers do, and what you, a slightly less paranoid citizen, can do.

- Prepper
- Casual survivalist

## COMMUNICATION

Establish a dead drop—a secret place to deposit and retrieve messages when communications go down. Tell only trusted confidants about this place.

Get your ham-radio license. Plenty of people still use ham radios to communicate, including FEMA. In a catastrophe, it might be your only option. (See page 62.)

## HEALTH

A properly equipped go bag, or bug-out bag, is heavy. Establish a training regimen on various terrains, so that you can flee without getting winded.

Pick up a fitness tracker. In a low-food situation, it'll track your vitals and even count your calories. In the meantime, you'll just be healthier.

## FOOD

Practice hunting the animals native to your area. Worth noting: Domesticated rabbits are less gamy than their wild counterparts.

Nonfood items you should have in your emergency pantry: manual can opener, Flintstones multivitamins, Sterno (for cooking).

## SHELTER

Build an underground bunker. Ideally, for ultimate secrecy, not on your house property. But that might also require a rather large purchase.

Have a list of emergency shelters. They should be accessible and sturdy—a public shelter, a church, your neighbor's basement, which also has a pool table.



## HEAT

If the power goes out, a woodstove is great backup. Better solution: an outdoor wood furnace that connects to your home's existing heating system.

Store a couple of ceramic flowerpots in the closet. Two pots nested, turned upside down, and propped above a few candles make an effective space heater.

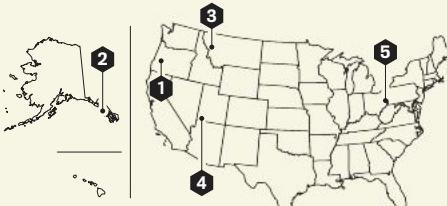
## WATER

Capacity of your cistern equals (one gallon per person) times (number of people) times (number of days of expected cataclysm) times (ten—just to be safe).

Keep a large water-filter pitcher in your fridge. Good for everyday use and as a filtration system. At the first sign of trouble, fill all extra containers and the bathtub.

## THE FIVE SAFEST CITIES

Taking into account nuclear fallout, natural disasters, extreme weather, proximity to fresh water, and even violent-crime statistics. Another benefit: They're all quite lovely. BY CAMERON JOHNSON



**1 EUGENE, OREGON**  
Very mild climate. No threat of hurricanes and only a minor risk of tornadoes, earthquakes, and volcanoes. Great if you don't mind ceaseless rain—or plaid.

**2 SITKA, ALASKA**  
The big advantage: You're already used to being isolated. Surprisingly mild year-round, despite being in Alaska. An abundance of wild food sources.

**3 MISSOULA, MONTANA**  
Surrounding mountains keep extreme weather at bay. Very low threat of natural disasters. The Clark Fork River runs right through town.

**4 HURRICANE, UTAH**  
Unfortunate name, yes. But its desert climate will suit cold-weather haters. Two nearby reservoirs and the Virgin River provide water.

**5 WHEELING, WEST VIRGINIA**  
No major hurricane, earthquake, or tornado threats. Far enough south to avoid lake-effect snowfall. The moonshine keeps you warm.

## THE ESSENTIAL SURVIVAL BOOKSHELF



**ALIVE: The Story of the Andes Survivors**, by Piers Paul Read

"The last discovery in their search for new tastes and new sources of food were the brains of the bodies which they had hitherto discarded. Canessa had told them that, while they might not be of particular nutritional value, they contained glucose, which would give them energy; he had been the first to take a head, cut the skin across the forehead, pull back the scalp, and crack open the skull with an axe. The brains were then either divided up and eaten while still frozen or used to make the sauce for a stew."



**ADRIFT: 76 Days Lost at Sea**, by Steven Callahan

Because if you have common sense, a little general knowledge, and a lot of fear, you can survive anything. And because he punches sharks in the face.



**SAS SURVIVAL HANDBOOK**, by John "Lofty" Wiseman

Everything you need to know.



**LIFE**, by Keith Richards



## Naked and Afraid Is the Best Survival Show

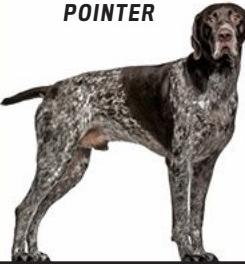
Everyone else is just playing.

BY DAVID CURCURITO

**B**EAR GRYLLS IS A WUSS. Les Stroud (you may know him as *Survivorman*) is just camping. Mick Dodge—well, that guy is pretty badass, but he's a barefoot lunatic. And almost all of the other hundred survival shows aren't actually about surviving, they're about living in a warm home deep in the woods (I'm talking to you, *Alaska: The Last Frontier*). The Discovery Channel is the only one that gets survival TV right, with its simple, genius *Naked and Afraid*. Two complete strangers, a man and a woman, meet completely naked—without food or water—in a desert, swamp, or forest. Then they walk the earth like God intended for a harrowing twenty-one days. Yes, it's the same damn show every episode: The two people get along, build a shelter, struggle to make a fire, and then starve while eating an occasional snake or dead bird. Or: The two people hate each other, build a shelter, struggle to make a fire, and then starve while eating an occasional snake or dead bird. But my fascination with the show isn't about skills or gender roles. What's entertaining is watching people come close to death from exposure and starvation. It's inspiring. And it's good to know that if, say, your Cessna crashes in the middle of nowhere, your body could actually function for a good chunk of time on stagnant water and snake meat. I could watch a whole episode just for the before-and-after photos. What a great way to lose weight.

### THE ULTIMATE SURVIVAL DOG:

THE GERMAN  
SHORTHAIRED  
POINTER



**DURING THE GOOD TIMES**, the preapocalypse, you want a dog that's loyal, smart, and obedient. You also want a dog that barks like hell when a stranger walks up your driveway. The German shorthaired pointer has these qualities and a lot more. The breed has pulled sleds, carried packs, and gone into battle with elite U.S. forces. Its webbed paws make it a good swimmer. It can be trained to retrieve game that you kill—or to kill small animals itself. The dog's versatility derives from deliberate breeding: Spanish and English pointers, the dalmatian, the vizsla, and a tracking hound all went into making this crafty canine. Its complex ancestry also makes it susceptible to few ailments and likely to live up to fourteen years. So maybe stock up on dog food too. — JOE BARGMANN

## THE SITUATIONAL GUIDE TO SUPERFLUOUS SURVIVAL

# GEAR

Stuff you  
may not  
absolutely  
need, but, boy,  
it'd be nice to  
have.

BY MATT GOULET



### YOU'VE GOT TO WORK IN THE DARK.

With six super-bright LEDs embedded in the handle, three flanking each side of the knife, the SOG BladeLight Folder (\$85) pulls double duty as a flashlight and a blade.



### YOU NEED TO KEEP WARM DURING A NUCLEAR WINTER.

The waterproof Westcomb Mission Parka (\$550) uses synthetic and natural down for maximum insulation.



### YOU WANT STEAKS, BUT A COOLER IS TOO CUMBERSOME.

Made out of the same durable material as white-water rafts, the Yeti Hopper (\$350) is incredibly tough, leakproof, and can keep contents cold for two days.

# AR



**YOUR HANDS ARE IN DANGER OF GETTING FROSTBITE.**

There's nothing warmer than real animal fur from the arctic.

Wolf, beaver, wolverine—in terms of durability and warmth, those hides beat anything synthetic. Boundary Fur Sewing will make you a pair of beaver-fur mittens for \$200. When the temperature dips below zero, you'll realize it's money well spent.

— NATE BECKER, DOG MUSHER, ALASKA (see page 55)

## THE DEFINITIVE GO BAG

Labeled in order of priority, for your convenience.

### FIRST PRIORITY

Eton FR150 MicroLink AM/FM emergency radio with built-in cellphone charger, hand crank, and solar panel. Essential.

Knife.

Maglite LED flashlight. Doubles as a weapon.

Extra batteries.

Whistle. (See "How To: Signal for Help," page 62.)

Mirror.

Flint and tinder.

Multitool.

Mylar blanket. Lightweight and warm.

Extra pair of weather-appropriate clothes.

Tarp, tube tent, or dropcloth.

Paracord (a hundred feet). Durable and versatile.

Any necessary medication.

First-aid kit.

Nonperishable food, such as MREs or canned goods. (See "The Dehydrated-Food Taste Test," page 61.)

Water bottle with filter, LifeStraw, or canteen.

Canteen cup.

Gloves. Thick enough but not too thick.

Rain poncho.

Local maps, preferably topographical.

Waterproof matches/butane lighter.

Potassium iodide/chlorine tablets. A few drops decontaminates your water.

### SECOND PRIORITY

Collapsible shovel. For fire pits and latrines.

Metal spork.

Insect repellent.

Toilet paper. (See "How To: Loot," page 63.)

Soap.

Sunscreen.

Garbage bags. Good for food storage or a makeshift poncho.

Sunglasses.

Watch. Glow-in-the-dark, if possible.

### THIRD PRIORITY

Waterproof document packet: ID, passport, birth/marriage certificates, deed/lease, car title, insurance information.

Cash. Small denominations.

Twelve-hour candle.

Wet wipes. For hot wings.

Hand-cranked can opener.

Hand sanitizer. Bonus: highly flammable.

# GEAR

CONTINUED



### YOU NEED TO TAKE SHELTER FAST.

Building a shelter can be a chore. With ENO's JungleNest Hammock (\$100), you get full coverage with an integrated mosquito net and rain guard, and it packs down smaller and lighter than a tent.



### YOU'VE LOST CONTACT WITH YOUR LOVED ONES.

The GoTenna (\$300) is sold in pairs and uses long-range radio waves to transmit text messages and locations through an app on your smartphone. So when service disappears, your phone basically becomes a walkie-talkie with more than a mile range. In emergencies the device can also transmit a ping of your location to every GoTenna within reach.



### YOU'VE BEEN FORAGING ALL DAY AND REALLY NEED A PICK-ME-UP.

Stanley's Mountain Coffee System (\$50) is a complete coffeemaking kit nested around a thermos that keeps drinks hot for up to twenty-four hours. The cap stores enough freshly ground coffee for two cups.

### YOU LOST YOUR LAST HATCHET.

By detailing the handle and sheath of their Freescape Hatchet (\$57) in neon green, Gerber ensures you won't lose this tool. The sheath slides conveniently into the handle for easy storage while you're hacking away.



### YOU'RE SHORT ON FUEL IN THE MIDDLE OF NOWHERE.

When the gas light flips on or your generator starts to sputter, you'll want this. Magic Tank Emergency Fuel (\$20 for a half-gallon) is nonflammable, has a ten-year shelf life, and acts just like regular gas.



### YOU'VE GOT TO FLEE BUT WANT TO TAKE EVERYTHING YOU OWN WITH YOU.

Eddie Bauer's First Ascent Maximus Duffel Bag (\$169) uses rip-proof and bombproof thermoplastic polyurethane. Closed, it's the size of a book bag. Open, it has 150 liters of storage.





## THE GOURMET SURVIVAL KITCHEN

**There's no point in stocking delicious food if you can't cook it.**

BY WYLIE DUFRESNE

**I'VE SPENT A LOT OF TIME** thinking about and preparing for disasters. To tell the truth, I started out on the fringe, buying enough military surplus Meals, Ready-to-Eat, or MREs, to put me on a government watch list. But then about a year ago, I realized my plan was absurd: My kids won't want dehydrated veggie burgers. During the apocalypse, your duty is to keep up morale—and nothing is better for

that than a great meal. To make one, you still need to be able to cook. Here, a few essentials.

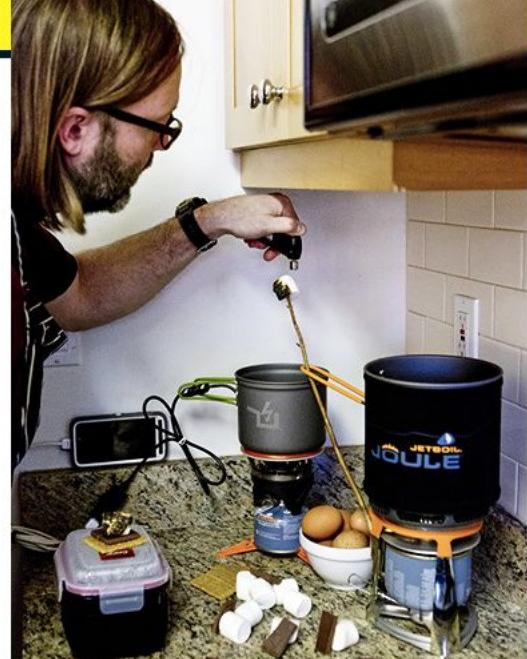
### FIRE

Matches don't take up much space. Keep them around. And make sure the ones you buy are storm-proof. (You can make your own by dipping standard matches in melted wax.) I also recently discovered the Soto Pocket Torch, which turns certain disposable lighters into a minitorch. It's great for mending a frayed piece of paracord or, better yet, making s'mores in your living room.

### A CAMP STOVE

One of my favorite portable stoves is the Jetboil Joule Cooking System. I like Jetboils in general, but this one is serious: It puts out 10,000 British thermal units, and the pot on top holds more than two liters, which is good for when you need to cook for a few people.

You should also have a PowerPot: The five watts of energy it creates while heating water (up to 1.4 liters) will charge any device that plugs in to a USB.



### A WORST-CASE-SCENARIO STOVE

If you are without matches or any other way to produce a flame, you can still make a hot meal if you have the Barocook system. It works the same way MREs do, by generating heat with a chemical reaction. You simply pour water over the heating pack, then put a tray of food on top. So in the middle of the worst, you can just pretend you're at a really weird buffet.



When times are tough, nothing lifts spirits like gooey s'mores. And booze.

## THE DEHYDRATED-FOOD TASTE TEST BY KEVIN DUPZYK

Dehydrated foods are perfect for emergencies: nonperishable, lightweight, and easy to prep (just add water). But do they taste like actual food? One staffer ate them for a week to find out. Some highlights.

BREAKFAST	LUNCH	DINNER	DESSERT
<b>BACKPACKER'S PANTRY ORGANIC CINNAMON APPLE OATS &amp; QUINOA</b> Slightly better than instant oatmeal, and the quinoa ups the nutritional value.	<b>MOUNTAIN HOUSE WRAPS BREAKFAST SKILLET</b> The eggs are fully cooked and then freeze-dried, so texture is off. The sausage and peppers help, though.	<b>BACKPACKER'S PANTRY PAD THAI</b> Delicious food for the pretentious prepper: international, vegan, and gluten free. It also has 460 calories, which you'll need.	<b>GOOD TO-GO HERBED MUSHROOM RISOTTO</b> Created by an Iron Chef winner, and it shows—perfect risotto texture. Suitable for dinner parties.
<b>NATURAL HIGH BBQ BEEF WITH MASHED POTATOES</b> Great idea, terrible execution. Dry potatoes and more BBQ sauce than beef.	<b>ASTRONAUT ICE CREAM SANDWICH</b> Tastes exactly like an ice cream sandwich, can't melt, and no brain freeze. So, just fantastic.		

### PREPPER JARGON DECODER

↳ **MAD:** Mutually assured destruction, e.g., nuclear war. ↳ **WROL:** Without rule of law. ↳ **YOYO:** You're on your



## Consider the Ham Radio

For emergencies or just idle chatter.

BY JASON FEIFER

**T**HIS IS KD4DYV," I said, announcing my ham-radio call sign for the first time in twenty years. "Can anyone hear me?"

Static.

I fiddled with my handheld radio, an old Icom IC-W2A, and tried again. Nothing. The radio was all that remained of a childhood hobby, back when I also had a big, boxy rig hooked up to a thirty-two-foot antenna in my parents' backyard, and a

Morse-code key for tapping out messages. The technical name for all this is amateur radio, an old-timey pursuit in which operators pass a test, acquire a license and call sign from the Federal Communications Commission, and then spend their days chitchatting across the globe. The term ham was once an insult, a name professionals gave to amateurs with clumsy Morse skills and mediocre equipment.

When I joined as a squeaky-voiced 12-year-old in the 1990s, it was like discovering the Internet before the Internet. Ham is built upon the thrill of the contact: Operators routinely hold contests to reach, say, someone in every state, or they clamor to talk with a fuzzy voice floating in from some far-off island. To confirm conversations, they send each other a personalized postcard. I had hundreds on my wall.

But then I grew up. Now I'm 34, married, and with a kid on the way, and last fall my dad found my expired ham license. At first I filed it away as a memento. But then I remembered: When a disaster strikes, ham radios are pivotal to survival. Operators become community lifelines, with hams talking to each other and working with first responders to relay local conditions. There's even the Amateur Radio Emergency Service, a volunteer

based group. I still owned my old handheld, and it seemed foolish not to have it at the ready. So I renewed my license for free and set about seeing how ham has fared in the digital age.

The answer: quite well. There are now almost 725,000 licensed hams in the U.S., an increase of almost 200,000 since I bailed two decades ago. In part this is because of new technology that enables talk on previously inaccessible frequencies. And to encourage newcomers, the FCC no longer requires that hams know Morse code. There's also a new smartphone app called EchoLink that patches hams into transmission repeaters, devices that receive weak signals and retransmit them with more juice.

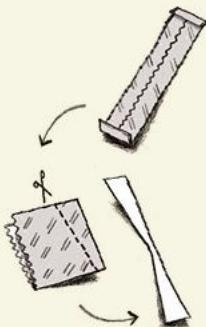
With my radio busted, I downloaded EchoLink and found a repeater near my Brooklyn neighborhood. "This is KD4DYV," I said again. "Can anyone hear me?" This time a voice rose from the static: It was Zane, a dad who lives down the street, and who earned his license two months ago. Zane recommended buying a \$30 Baofeng UV-5R. "I'm on this repeater pretty often," he said, inviting me to return. I will, with my new radio. It's good to know I can reach a friendly voice. Hopefully just to chat, but also just in case.

### SURVIVAL HOW TO

#### SIGNAL FOR HELP

"If you have a whistle, use a one-two-three, pause, one-two-three pattern. This is more recognizable to the human ear. Mirrors are also important. Nothing in nature can be mistaken for a signal mirror. Same goes for brightly colored construction tape." — THOMAS COYNE, FOUNDER AND CHIEF INSTRUCTOR, SURVIVAL TRAINING SCHOOL OF CALIFORNIA

#### HOW TO: MAKE FIRE WITH A GUM WRAPPER AND AA BATTERY

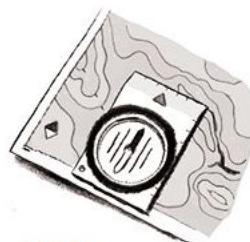


1 Fold an open wrapper in half, width-wise.

2 Fully cut diagonally from the open side to almost the edge on the folded side. Unfolded, the two ends should be wide triangles and the connecting portion as narrow as possible.



3 Hold the foil side of each end on opposite terminals of the battery. The middle section will burst into flames. Have tinder ready.



#### HOW TO: ORIENT A MAP

Align north on your compass with the map's vertical grid lines. Rotate the map and compass together until the needle reaches north.

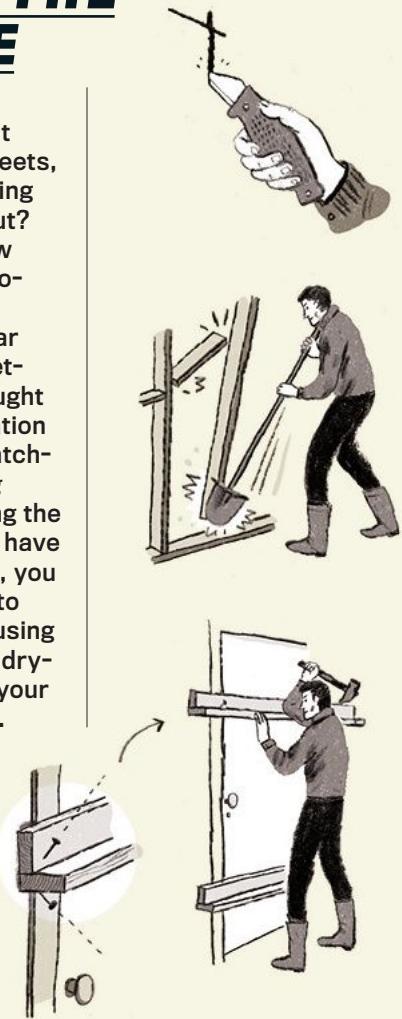
#### HOW TO: TURN YOUR CAR INTO A GENERATOR

Car electricity runs on direct current, but almost everything else is alternating current. What you need: an inverter. Some cars have them built in, but you can get one at a store for less than \$40. Use the clamps to attach the inverter directly to the terminals on your car battery. Let the car run at idle and you have 110-volt AC power for as long as you have gas. With a 300-watt inverter, you'll have enough amps to run a laptop or even a television.

**HOW TO:**

# BARRICADE YOUR HOUSE FROM THE INSIDE

When bands of marauders start roaming the streets, how are you going to keep them out? Tear down a few walls, says Timothy Ferraro, a twenty-five-year construction veteran who's thought about this situation plenty while watching *The Walking Dead*. "Assuming the attackers don't have a battering ram, you should be able to keep them out using the lumber and drywall already in your home," he says.

**HOW TO:**

## SWIM A LONG DISTANCE IN FREEZING WATER

→ **Kimberley Chambers**, open-water swimmer and the sixth person to ever complete the Ocean's Seven marathon challenge.

**BREATHE.**

You must control your breathing and relax—even when the freezing water makes it feel like there's a foot on your chest. Panicking wastes energy.

**KEEP MOVING.**

Even if you think you are not making any progress. As soon as you stop, you lose precious body heat.

**FLEX YOUR HANDS.**

An early sign of hypothermia: claw hands. You can last a long time after this, so flex your fingers closed after each stroke to get blood flowing again.

**HOW TO: LOOT**

Don't bother with the fifty-inch flat screen.

If the world ends, everyone else will be grappling over water, gas, candles, and canned food, all of which you've wisely stored in advance. So take this opportunity to stock up on useful stuff they won't think to take: lip balm and lotion for your soon-to-be-wrecked lips and hands, Vaseline and cotton balls to use as fire fuel and kindling, vitamins, and all the antibiotics you can carry. Kevin Reeve, CEO of OnPoint Tactical survival school, recommends grabbing the penicillin, Flagyl, Cipro, Zithromax, and Augmentin, as well as painkillers such as Percocet and Vicodin. Get tampons if you intend to bring any women with you, and cigarettes, alcohol, and lighters that you can trade for whatever you forgot. "And take everything they have in the way of toilet paper," Reeve says. "We call it mountain money."

**WAMPUM:** A stockpile of ammunition that can be used for trade or as currency. → **GOBLIN:** Someone who will start looting or committing other crimes in a

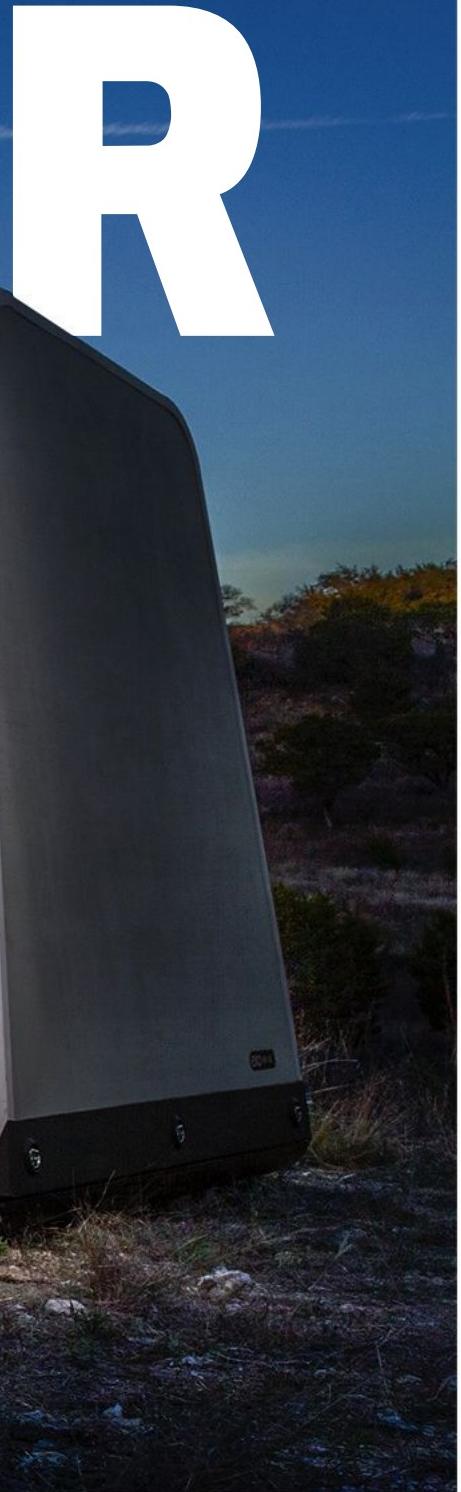


# SHELTER

It's the same with any catastrophe around the world: The displaced are put up in tent cities, decrepit stadiums, or, if they're lucky, given vouchers for hotels hundreds of miles from home. But a company in Austin, Texas, has a better solution. A lightweight, portable, humane solution. And they let me move in.

BY NEAL POLLACK





#### THE GENERATOR IN THE EXO WENT DOWN AT MIDNIGHT.

One second I was sleeping in my bag on my cot, the space heater and minifridge soothing me with their chorus of electric hums. Suddenly the whole pod shook. My phone, plugged in beside the cot, emitted a little squirt of noise. There was a thunk as the electronic deadbolt unfastened. Then it was dark. Without power, the pod's LED-illuminated, capacitive-touch panel, which operates the lights and locks, had gone blank. The digital readout—a four-digit number like an address—on the pod's exterior, which sent a little glow through the top of the skylight when it had power, had also been extinguished.

I considered not doing anything. It was snug in my bag, and the food in the fridge would keep for a while. But then I felt the wall next to me. A molded composite shell gets pretty cold at night in December, even in Texas. I touched the floor. It was also chilly. The heater had been on high, and it had kept the Exo just warm enough. In another hour my pod would be an ice bucket, and I would be very uncomfortable.

I got off the cot, groaning like the middle-aged man I am. Lumbar support isn't a high priority for disaster-relief bedding. I pulled on my sweater and hiking boots. Hot pain stabbed across my sacrum. Flashlight in hand, I stepped outside into the Texas Hill Country and trudged the fifty or so yards to the generator. The gas cans had those protective spouts on them. It was a two-person job. But I didn't really have a choice. I was alone out there.



**THIRTY-SIX HOURS EARLIER, I'D DRIVEN ONTO THE FIELD IN THE MIDDLE OF** the game preserve where I'd be living for the next two days. There sat the Exo Mark 4 disaster-housing prototype, looking like a giant space egg with a square top, or a distended version of the orgasmatron from Woody Allen's *Sleeper*, or perhaps a porta-potty from the future. An actual porta-potty had been set up a few hundred yards down the road, past a cattle guard, just far enough so that there'd be no way for me to reach it after dark without spraining an ankle.

Michael McDaniel, the CEO of Reaction, the Austin, Texas-based company that makes the Exo pods, was waiting for me, along with the preserve's owner. They were laughing. I'd driven up in a Prius. A camper I'm not. But this made me a perfectly good test subject for the Exo. It's designed for ordinary people in extraordinary circumstances. Since I was the first noncompany employee to ever spend the night in one, my circumstances were extraordinary enough.

Emergency housing is in a wretched state. Millions of refugees who have fled the Syrian crisis live in makeshift dirt-floor tents held together by duct tape and cardboard. In Port-au-Prince, Haiti, years after a horrifying earthquake, displaced people are still squatting in scrap huts. Our domestic solutions—stadium housing and FEMA trailers—are only marginally better.

McDaniel says he dreamed up the Exo after Hurricane Katrina, when he saw how shoddily the refugees had been treated and housed. He cut a "door" out of the bottom of a Styrofoam cup, and then spent the next decade madly working on a unit in his backyard and garage, obsessed—like Richard Dreyfuss sculpting a Devils Tower out of mashed potatoes—with creating stackable, modular, efficient disaster-relief housing. Now he has millions of dollars in seed funding and a growing staff highlighted by a chief engineer who most recently worked at Boeing on numerous airliners and who had previously designed satellites for NASA. Before the molded composite has even dried on the prototypes, Reaction is preparing Exo for mass production.

The pods come in two pieces: the shell, which is made out of a proprietary mix of materials as secret as a Texas pitmaster's barbecue rub, and the



↑

Each Exo, seen here in prototype form, is fully wired and has a personalized digital security system. Future versions will be equipped with air conditioning and running water.

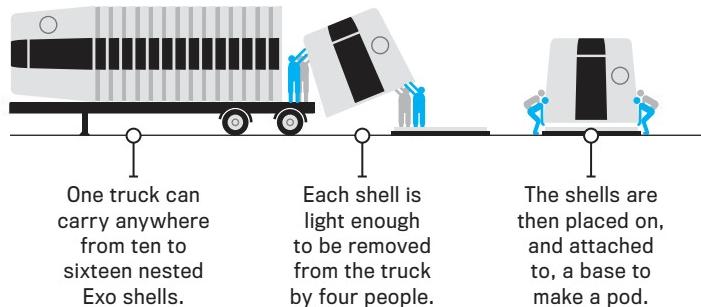
floor. The Exo's base measures 9 feet 6 inches by 8 feet 4 inches, and the structure stands 8 feet 4 inches tall. Altogether it weighs 400 pounds, though McDaniel says they can get that down to about 300 pounds. Regardless, the Exo can easily be lifted into place by four people and assembled in about five minutes, and it comes as wired as the smartest of smart homes.

McDaniel handed me a radio-frequency-identification (RFID) bracelet, like what I'd get for admission to a music festival. All Exos, even in the most extreme scenarios, will have personalized digital security, access to a power source, and built-in LED lighting. I walked up to the pod and swiped the bracelet across a lit white circle next to the front door. The circle swirled and turned green. The bolt unclicked. I opened the door and stepped inside.

The Exo is fully modular, almost like Lego housing. There's a desk attachment available so it can become a field office, and there's even a version in the works that could house a mobile surgical unit. Mine was more of an extreme bachelor edition. Bunk beds had been clipped to both side walls. The beds on the east wall were folded up to fit a space heater and minifridge.

## THE PRINCIPLES OF EMERGENCY HOUSING

Reaction's Exo disaster shelters are designed for easy transport.



The pod's interior felt generically futuristic, very *Starship Troopers*. It could have used a nice print or two, or even a One Direction poster. I turned on the LED lighting, which gave the space a dystopian, interrogation-room glow. There were electrical outlets on either side of the rear wall. I plugged in my phone, put my stuff down, and sat on the bunk.

Well, here I was.

On the first night I drank a few beers, read, and ate dinner. It was lonely, but I felt strangely comfortable, securely locked inside my pod. The next morning was damp and chilly. I drank some coffee and stretched out on the floor, which was freezing to the touch and covered with a coat of fine Texas dust. Fortunately, Exos are designed to be easy to clean.

After a nice three-hour hike around the ranch, I returned to the pod, swiping my RFID bracelet. The shelter was now sweltering. McDaniel says he's working on a version of the Exo that has a built-in air conditioner, as well as louvered vents in the front. That also seems like a needed innovation. It was only 65 degrees Fahrenheit outside.

But these are just prototype observations. The Exo has enormous potential. The units can be fit together to form a multiroom home of sorts. A wet unit, containing running water, is also in the works. Beyond its intended relief mission, it could, and most likely will, be used for other purposes: for workers in the North Dakota oil fields, campers at a music festival like Bonnaroo, or in dozens of other scenarios. The pods aren't fancy, and they're not cozy, but they're secure, fully wired, and they have access to power. If I'd just lost my house in a disaster, I'd be thrilled to get one. It sure beats a tent.

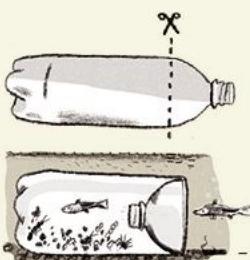
I tried to keep that in mind on my last night as I stumbled grouchily in the dark toward the generator, lifted the heavy gas can, and dribbled fuel all over myself. McDaniel says multiple Exos can run off a generator truck, portable solar panels, or can be hooked into a power grid, if available. That would have been nice.

After twenty minutes or so of incompetent maneuvering, I got some gas into the tank. The generator roared to life and the Exo lit up in the field, glowing like it was ready to be carried back to its home planet. It looked oddly beautiful and delicate. I imagined hundreds of them strung together, forming a village of temporary modular housing, linked by a central computer system, shining in the night. That could happen. McDaniel says that by the end of 2015 Reaction will be making 500 Exos a month. Demand is that high.

For now, though, there was only my prototype. I went back to bed, my hands stinking of gas. The only soap was in the porta-potty, which was way back in the woods. On the night of a full moon, I had no intention of leaving the security of my cocoon again. I could feel the cold metal of the bunk bed against my hand. But it was warm enough inside the pod. The heater swiveled. I went back to sleep, safe from whatever disaster might befall me next.

## A FEW SURVIVAL TIPS FROM THE

# SPECIAL FORCES

**HOW TO CATCH MINNOWS WHEN YOU'RE STARVING**

- 1 Take a two-liter bottle, remove the cap, and cut off the top quarter.
  - 2 Turn the top upside down and place it in the bottom three-quarters of the bottle.
  - 3 If you have string,
- make a small hole at the top of both sides and tie an end of the string to each. This is your handle. If you don't have string, use rocks as an anchor.
- 4 Place bugs or other bait in the bottle bottom to attract fish.

**YOUR EMERGENCY SHELTER, TWO WAYS**

- 1 Crawl under the biggest evergreen you can find. Get right up to the trunk.
- 2 Break or cut off enough boughs that you have room to move around or at least sit up without being poked.
- 3 Use the branches you cut off, and any other fallen branches or clusters of pine needles nearby, to line the ground for bedding and insulation.
- 4 If there is snow, use a shovel or your hands to dig it out. Pack down the sides of the hole for walls.



- 1 The materials: a tarp or dropcloth at least 8 by 10 feet and a minimum twenty-five feet of cord (preferably parachute cord).
- 2 Locate two trees roughly eight feet apart. Tie your line around one of them. If it's warm, the cord should be higher off the ground to let in more air and vice versa.
- 3 Secure the tarp to the cord. If your tarp has grommets (holes with metal rings), pull the line through them on both sides. If it does not, use a buttoning technique (bottom right) before tying the cord to the other tree.
- 4 Stake your tarp into the ground. If you don't have stakes, use heavy logs to weight the corners.

**THE POSTAPOCALYPSE BIKE:**  
**SPOT BRAND CREAM SS**

transportation. The Cream (\$8,700), a mountain bike made by Spot Brand in Golden, Colorado, can handle smooth pavement and rugged wilderness trails alike. It's also low maintenance. The frame is sturdy titanium, and it's a single-speed, so no gearing to fuss over. The drive belt needs no lube and is nearly silent—good for keeping a low profile.



When society collapses, a bicycle becomes the optimal mode of

**BUGS, NOT BERRIES**

Eat bugs instead of berries or plants. The wrong plant could debilitate or kill you. Bugs just taste bad, and they're an abundant source of protein. But remember: six legs or less to avoid potential poisoning, and roast them if possible to cook away parasites.

**LAST-RESORT FOOD, IN ORDER OF DESPERATION****SNACKY**  
Orange and watermelon rinds

Fiber-rich, pairs well with chocolate.

**HUNGRY**  
Tree bark

Remove the tender inner layer, called cambium, and boil strips of it as you would pasta or grind to powder for thickening soup.

**FAMISHED**  
Leather

Avoid dyes or treatments, if possible, and boil in water to soften. Can also be roasted into chips.

**DYING**  
Dirt/clay

Dig deep to avoid pesticides. If able, bake to kill bacteria, then boil for 30 minutes and strain. Dirt is nutrient rich, and clay is filling.



Nick Meyers in full rescue gear at Shasta-Trinity National Forest.



**PREPPER JARGON DECODER** | **DEEP LARDER:** Long-term food storage. → **GOLDEN HORDE:** The mass of helpless city dwellers who will

EXPERT

SURVIVAL

DISASTER  
LEVEL:  
APOCALYPTIC

# NICK MEYERS

DIRECTOR, MOUNT SHASTA AVALANCHE CENTER,  
MOUNT SHASTA, CALIFORNIA

A fourteen-year veteran of the U.S. Forest Service, Meyers has been the lead climbing ranger of the Mount Shasta Ranger District since 2010. His team is on call year-round to lead search-and-rescue efforts, averaging ten to twelve annually.

## AVALANCHES

An avalanche needs a few things to happen: a slab—a cohesive mass of snow—and a surface for it to slide down, like a frozen crust, hard old snow, or the ground. It needs a slope of between 30 and 45 degrees. Less isn't steep enough, and more will cause the snow to slough off naturally. And it needs a trigger, like a skier or a snowmobile—which is how you get into trouble.

If someone gets buried, finding him is no longer the hardest part, thanks to avalanche beacons. Digging him out is. When you've located him, use your avalanche probe: Stick it into the snow as a marker of his position and depth. Take one large step downhill and dig from there. You'll be digging in toward the person—not down onto them.

## KEEPING WARM

If you're stuck out in the wild, the first thing you need to do is avoid exposure. Wind saps your body temperature and increases the risk of hypothermia. Keep moving to maintain blood flow and retain body heat. No matter what, never go 100 percent. Always leave a little gas in your tank, because you never know when you'll need it.

## GEAR

We use a list called the ten essentials. It's not definitive—I bring a few extra pairs of socks and, in the winter, a hat, a small bivy sack, and a ground pad are also crucial—but these things will buy you time in a survival situation.

### ❶ MAP AND ❷ COMPASS.

Make sure you know how to use them (see page 62). A lot of people substitute GPS. GPS can work very well, but it has its limits. In cold weather batteries don't last very long—and if they run out, you're bummin'.

**❸ FIRST-AID KIT.** You want to at least be able to stop bleeding and splint an arm. It doesn't have to be giant, since there's not a lot you can do in the field anyway.

**❹ SUNGLASSES AND ❺ SUNSCREEN.** If you are someplace with a lot of snow, like we are, snow blindness is a real concern. And the snow reflects the sun's rays.

**❻ EXTRA FOOD.** They may be smashed, old, and beat up, but a couple of Clif bars can keep you going for another twelve to twenty-four hours.

**❼ FIRE STARTER.** There are a lot of options. Try stocking your kit with this: Take lint from the dryer, put it into a paper cup, and pour wax on it. Put it beneath some kindling, and light the whole thing.

**❽ EXTRA CLOTHING.** Avoid cotton. Once it gets wet, it loses its insulation capabilities and doesn't dry very fast. Synthetic clothing is better. Always have some sort of wind layer. People underestimate the chilling effect of wind. It can be extremely hazardous. On Shasta the wind is just brutal, and that can lower your core temperature pretty easily.

**❾ MULTITOOL.** It tends to have a knife on it, so I steer toward that. And it also has other tools.

**❿ HEADLAMP/FLASHLIGHT.** In every pack. You never know.

—as told to Kevin Dupzyk



## Where I'm Going

The case for the eschatological contingency plan.

BY JACQUELINE DETWILER

**F THE WORLD ENDS,** a lot of folks are going to get very lost. Without email or smartphones, families scattered across the country that rely on long-distance communication will be forced to find one another in real life again, in a countrywide game of postapocalyptic Marco Polo. I've read Stephen King's *The Stand*. This is not going to be easy.

Assuming all goes well, my family will be better off than most: We got drunk at my mom's birthday dinner one year and unintentionally chose our apocalypse rendezvous location. At the time my brother Joe was living in Boston, and my parents were in Beaumont, Texas. I lived in New York City. With so much country in between us, how would we avoid missing each other?

To start, we considered a family's needs: land that would remain dry even if sea levels rose. Fresh water. Vegetables. A city large enough that we could find it but small enough that it wouldn't be overrun. This was easy: Triangulating from our homes cut a halcyon crescent of potential locations west of the flood-prone Eastern Seaboard and north of the flood-prone Gulf Coast. We could go to Memphis, Nashville, Roanoke, Texarkana, Little Rock.

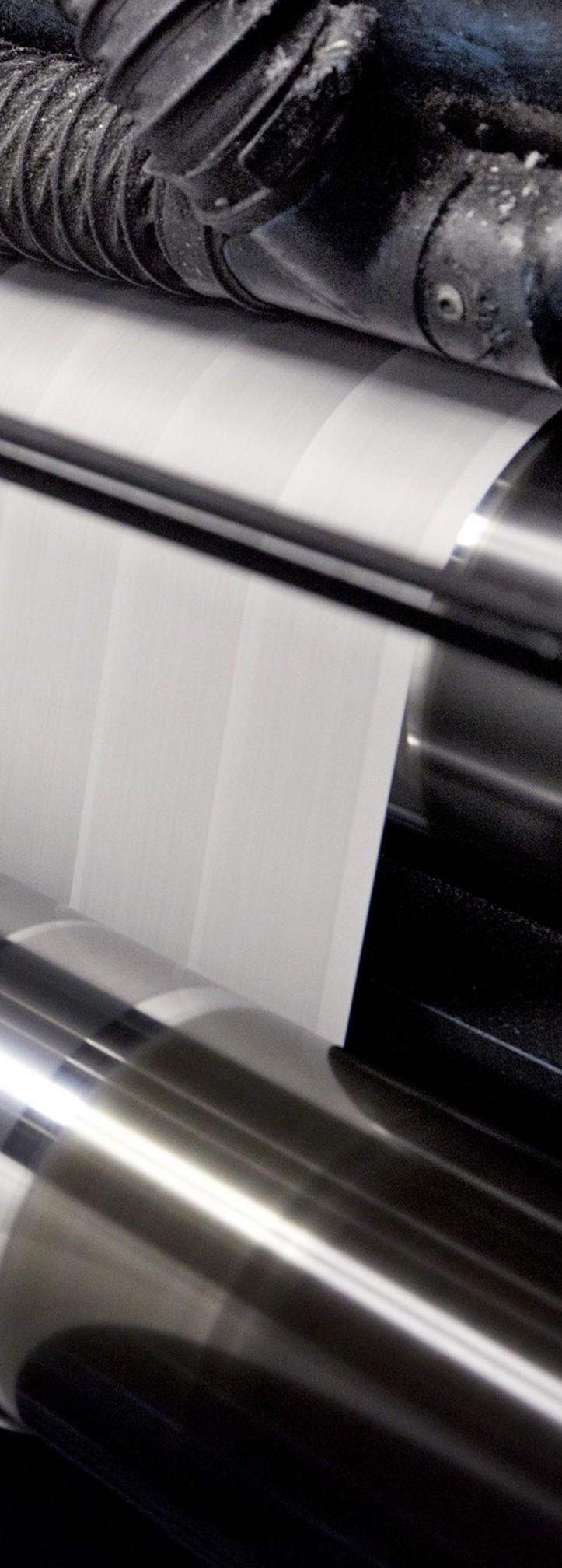
The harder part was coming up with a recognizable landmark to meet under. It would have to be large, unmistakable, and still standing no matter what calamity befell the earth.

I helpfully announced that I had been to Louisville, which possessed just such a landmark (and happened to be surrounded by warehouses of bourbon). This was roundly met with expressions of praise. And so, even though we initially chose it in an inebriated thought experiment, I'm going for it: If the world ends, I'll pack up the good knives, loot all the supplies I can carry, and make my way to the Louisville Slugger Museum & Factory. There, if I'm lucky, my parents and brother will be waiting, under its 120-foot decorative bat.

pour out of metropolitan areas in an emergency. → **OPSEC:** Operations security. Sharing your survival plans with other people is weak OPSEC. ☑



At the main printing plant in Queens, seven presses run between six and eleven hours a night to print 300,000 copies.



# THE DAILY MIRACLE

*How The New York Times works.*

By REEVES WIEDEMAN

Photographs by WILL STEACY



**1:35 A.M.** ERNIE BOOTH, THE OPERATIONS MANAGER OF THE MAIN **A TUESDAY** printing plant of *The New York Times*, is walking the floor. The plant is a 515,000-square-foot building in Queens, on the Van Wyck Expressway, half a mile from LaGuardia Airport. Booth is a big man with enthusiasm to match his heft, and tonight he's wearing a collared shirt, sweater, and chinos in various shades of beige. He glides through the place like a small-town mayor, jabbing the noisy air with quick chin nods, offering ritual greetings to some of the 350 employees who work here each night.

"What's happening, Tom?"

"Hey, Andy."

"All quiet, Dennis?"

Dennis Diaz, a coordinator in the control room, responds that one section of the plant's fourteen miles of conveyor belts is not working.

Booth draws a breath and scans the control room, a glass-walled office he compares to an indoor air traffic control tower, overlooking the floor. "You see all these flashing things?" he says, pointing to one of several screens displaying different parts of the plant. "Flashing things are bad. Flashing things mean we have a problem." He appears to have a lot of problems at the moment. But this night is not much different from most, and Booth's only real complaint as he circulates

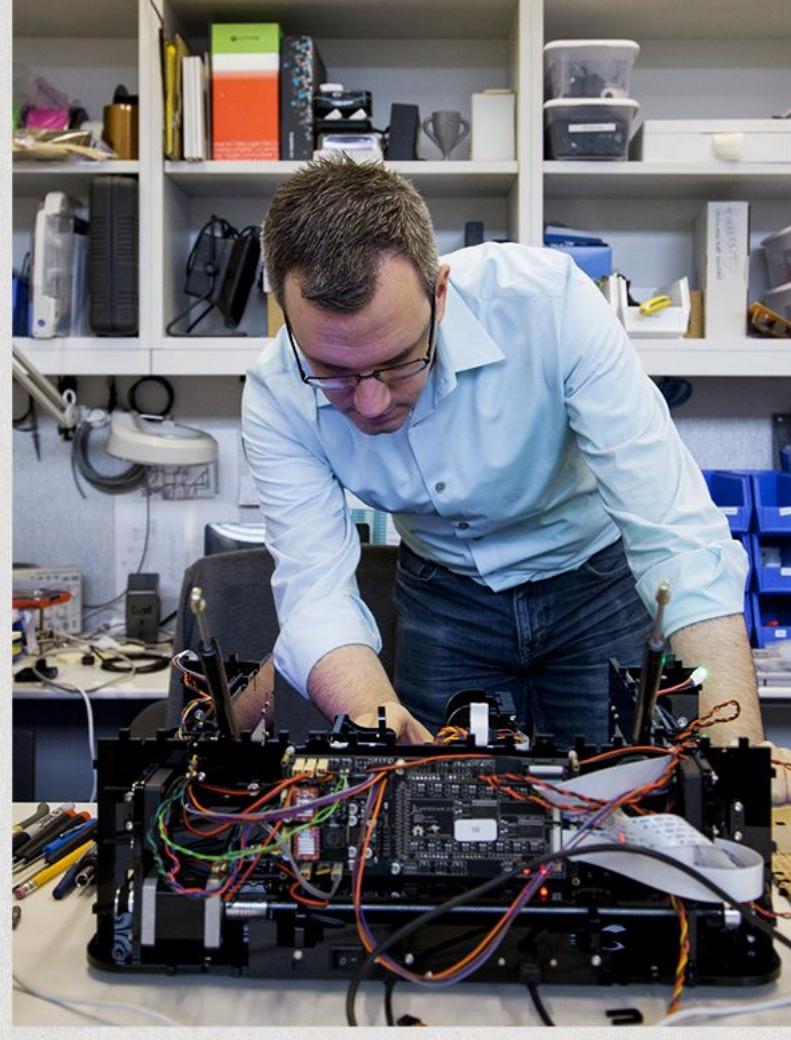
*continued on next page*

the floor is that he'd rather be on his wheels: The plant is so large that many employees travel from one area to another on adult-size tricycles. (Booth has a trike and a golf cart.) During daylight hours, when the plant isn't in use, the *Times* sometimes rents it out—in the most recent Jason Bourne movie, it stood in as a crowded factory in the Philippines.

Tonight, like every weeknight, the plant will print more than 300,000 copies—double that on the weekend—which by 3:25 a.m. have to be loaded onto dozens of trucks. The straight trucks, which are already at the loading docks, can fit eight pallets each, holding a total of 14,000 individual copies. The trailer trucks carry twenty-four pallets, a load of 50,000 copies. The trucks will make about eighty departures from the plant by tomorrow morning, fanning out to other distribution points, from which the copies will be delivered to grocery stores, bodegas, office buildings, and newsstands from New Haven to Albany to Trenton. Booth used to spend his nights waiting for the trucks to arrive—he had a *Times* paper route in the Riverdale section of the Bronx starting in 1986, when his daughter was born and he needed extra income.

Booth got here at 4 p.m. and will work until the last truck leaves. "Sometimes we'll get out at 3, sometimes we'll get out at 7," he says. "You're dealing with night people—we're vampires here." Tomorrow morning, most readers will think nothing of the fact that the paper was at their door at the same time yesterday and the day before that and the day before that. They may also think nothing of the fact that, at the moment they bend down to pick it up, some of the stories in the print version have already been updated on their phones and tablets, and new stories have been added, too: the score of a double-overtime game that ended too late, or news out of India that broke overnight. And all of these stories, the total daily and nightly output from all the desks at the *Times*—news from Washington and Ukraine and Sacramento and St. Louis and Staten Island and Mexico City, reviews of movies that open tomorrow and of TV shows that aired last night, opinion pieces, recipes, weekly sections on home design and science and real estate and style and books—feed a larger world of news that never stops consuming. The growing universe of digital news outlets includes a great many amalgamators, recyclers of other people's reporting. Some report their own stories, but it is the *Times* that provides by far the most coverage of the most subjects in the most reliable way. The *Times* is a monster, a sprawling organization, the most influential print newspaper and digital news site in the world.

But it still makes most of its money by selling paper, and the paper on which tonight's edition is being printed arrived, as it does each week, from four different paper mills—two in Quebec, one in Ontario, and one in Tennessee—where it was packaged into rolls large enough to serve as the business end of a steamroller: 2,200 pounds each and fifty inches in diameter. Eighteen-wheelers carried them to a *Times* storage facility in the Bronx, where more trucks took twenty rolls each from there to the plant in Queens, where manned forklifts deposited each one in a four-story warehouse that can hold 2,231 just like it. The rolls now sit stocked in eight



**Matt Boggs runs the *Times'* R&D Lab, which tries to peer into the future of news. One project: figuring out how to use drones for newsgathering in ways "that don't annoy anyone and don't get us sued."**

rows on nine shelves, four deep, like soup cans in a grocery store for giants. Conveyor belts deliver them to the paper-handler area, where the rolls are flipped sideways and land with a deep boom, ready to be loaded into press reels that feed them through slits in the ceiling. The rolls of paper unspool on seven different presses that will each run for between six and eleven hours by the time Booth clocks out. A plant worker attaches the end of each roll to the start of the next using giant pieces of tape, so the press never has to stop.

In the plate room Sergei Primachenko waits for digital files of each page to arrive from the *Times'* midtown Manhattan headquarters, ten miles to the west. (Ask Booth how often the editors there meet their deadlines and he will push his glasses down his nose and raise an eyebrow.) Primachenko seems to view many steps in the printing process as "mission critical." ("Having the precise amount of ink is mission critical.") Upon a file's arrival, a laser etches an image of the page onto a piece of oxidized aluminum, which is then washed in a sugar-based chemical like a roll of film being developed. A different plate must be produced for each of the press's four colors—cyan, magenta, yellow, and black—and because a single page might be printed in a different form in various editions, the plant uses 3,000 plates to print some fifty pages each night.

From there the plates are locked onto the press, and ink is put to paper. The presses can print up to 80,000 papers per hour, and it's noisy as hell when

Booth heads back out onto the floor—the decibel level can reach 87, loud enough to cause hearing loss over time. The paper zips up from the basement, zigzags through the press—which applies ink that sticks only to the areas marked by the laser—then jets back toward the middle of the room, where half a dozen pressmen in ink-stained jumpsuits grab pages off the press so that they can stare intently at a millimeter-wide box in the top-left corner of the page. If the box is black everything is in order, but if there's a hint of cyan off one edge, the plate is out of register, and the page must be readjusted. By the time a page is deemed ready for public consumption—called “first good copy”—the plant is likely to have printed several thousand copies that go straight to the recycling bin.

Each page is simultaneously folded in half by a machine and sliced apart, to be raced along the miles of conveyor belts, as if Rube Goldberg had designed a clothing rack for the world's busiest dry cleaner. The goal of the machine, one of only three in the world, is to get each paper out the door without being touched by a human hand. Along the way, various inserters open each copy, deposit ads from Macy's or Target, stack papers into bundles of fifty, strap them with plastic binding—snap! snap! snap!—with a speed that would make a dominatrix blush, and pile them on pallets to be rolled onto *Times*-branded trucks, which start pulling away in an order scheduled to the minute, bound for one of fifty depots, where paperboys and girls and men and women will pick up this morning's *New York Times* more or less the same way Ernie Booth did twenty-eight years ago.

» » »

**6:20 A.M.** LYDIA POLGREEN OPENS HER EYES, A WEDNESDAY rolls over in her bed, and grabs her iPhone. Her mind is already several time zones ahead. Polgreen is the deputy editor of the *Times'* international desk, which used to be called the foreign desk until somebody pointed out that the *Times* has readers all over the world. (As Polgreen puts it, “Foreign to whom?”) She scrolls Twitter to see what's trending. She scans the apps and websites of the *Times'* competitors. She reads the many stories that some of her seventy-five foreign correspondents filed while she slept. Then she gets out of bed and makes coffee. She needs to be at the *Times'* headquarters for a 9:40 conference call with the editors in Europe.

The *Times* is one of a dwindling number of media outlets willing to keep reporters in places where they aren't always wanted. Polgreen has worked as a correspondent in Senegal, South Africa, and India and knows the importance of being looked after. Reporters assigned to a country for the first time are occasionally taken totally offline for months or even a year—no stories to file, no office to report to—so that they can

learn the language and culture, an expensive and extraordinary commitment by the *Times*. In addition to monitoring their stories, Polgreen also must monitor the whereabouts and well-being of the reporters themselves. “If they disappear for a really long time, we'll definitely be like, Hey, what's up?”

Sometimes the *Times'* commitment to covering the entire world has dire consequences. In early 2012 Anthony Shadid, a *Times* correspondent who had won two Pulitzer Prizes for his coverage of Iraq, was in Syria for the uprising against President Bashar al-Assad. Shadid and *Times* photographer Tyler Hicks were in the country without the knowledge of the Syrian government, having entered Syria at night across the mountainous border it shares with Turkey, which is strung with barbed wire for much of the 500 miles. They scrambled over a barbed-wire fence, and guides on horseback, arranged by Shadid through a network of smugglers, picked them up. On the way out a week later, Shadid suffered a severe asthma attack, leaned against a rock, and collapsed. Hicks administered CPR for thirty minutes, but Shadid never recovered. He was dead. When a local doctor was finally persuaded to arrive on the scene, Hicks picked up his friend's body, hoisted it into the doctor's truck, and took it back across the border into Turkey.

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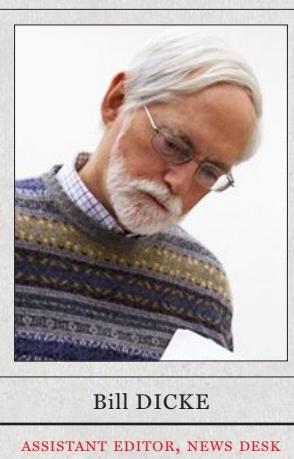
**11:50 A.M.** STACY COWLEY'S EYES MOVE AROUND ELECTION DAY her computer screen, bouncing between the *Times* home page and a half-dozen open chat windows. There is pizza coming later because it's Election Day, and on Election Day at the *Times* there is free pizza.

“Election Day is like the High Holidays around here,” Cowley's colleague Michael Owen says.

Owen and Cowley are the morning producers of NYT Now, the *Times'* first mobile app that has a dedicated newsroom team around the clock. It launched last April. This job—running an app—is like a growing number of jobs at the *Times* in that it didn't exist six months ago. Owen, tall and reserved, and Cowley, with glasses and long dark hair and a well-caffeinated energy, sit near the paper's news editors—different creatures living in the same forest. While Owen perches at his standing desk scrolling the Web for what's making news, Cowley sits at her desktop using old-fashioned news judgment and modern technology—a program tells her in real time how many people are clicking on any given story—to help determine what's worthy of keeping on the app this very second and what to replace with something more view-worthy. Bursts of text stream into her chat windows as editors jockey for position on the app. *Times* journalists communicate largely through a customized version of Gmail and a labyrinth of private chat rooms like these. “Until, like, six months



Lydia POLGREEN  
DEPUTY EDITOR,  
INTERNATIONAL DESK



Bill DICKE  
ASSISTANT EDITOR, NEWS DESK

ago we were literally communicating all day with AIM chat rooms," Cowley says. "Anyone in the world could have joined that chat room if they happened to find it."

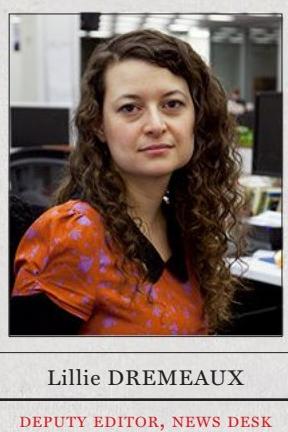
Just after noon Cowley is greeted by a young man in jeans and a blazer who works for the *Times*' Interactive News Team, a group formed seven years ago to train and develop a team of "developer journalists," programmers who code tools for the newsroom's use. He has built a bit of code that will deliver live updates to the NYT Now app as election results pour in tonight. Cowley plugs it in to the app's content management system, hits refresh, and watches as . . . nothing happens. The developer exhales, sits back in his chair, opens a laptop, and goes back to work.

"There's definitely a little MacGyvering happening here," Cowley says. "We're gluing the hamsters and the shoestrings together to make this all work."

No one at the *Times* is under the illusion that producing the world's most ambitious print newspaper alone will be enough to keep the company afloat. In the third quarter of 2014, print advertising decreased by 5 percent. But digital advertising was up more than 16 percent, and there is an increasing willingness in every section of the paper to try anything. On the twenty-eighth floor of the paper's Manhattan headquarters, around the corner from the company lactation room, is the *Times*' R&D Lab, a huge, open room with completely white walls and views that stretch deep into New Jersey and ceilings high enough to accommodate a small squadron of drones sitting momentarily idle on a shelf. "The drones are for droning," Matt Boggie, the lab's director, says. He's been working with the company's legal department to find out how to use the drones for news gathering in ways "that don't annoy anyone and don't get us sued."

Boggie is preparing the lab for a visit from advertisers—he gives tours of the lab regularly to business associates, school groups, and the like—and walks through the space messng around with various prototypes. On one computer an earthquake tracker can compose news-alert summaries of a story based on seismographic data. Next to it a computer tracks various cycles—the life span of a fad, the spread of a virus—based on how often certain keywords appear in *Times* articles. In the middle of the room, a PlayStation controller has been hooked up to a Mac to display all the traffic coursing through the *Times*' website, with flying hexagons representing published stories and blinking parabolas tracing visitors to the site. "I can't control it because I don't actually know how to use it," Boggie says. An assistant walks by and feeds a stack of papers into a shredder.

The R&D Lab opened nine years ago with the goal of looking three to five years into the future. (The *Times* declined to say how much it cost to build.) Marc Frons,



LILLIE DREMEAUX

DEPUTY EDITOR, NEWS DESK



>>>

the company's CIO, who oversees the lab, says he has no idea how people will interact with the *Times* in ten years, "whether it's on your wrist, or your forehead, or you take a pill, or it's a holographic contact lens, or a head-up display in your vehicle—or on your mirror in your bathroom." The lab explored E Ink before the Kindle even existed, was responsible for delivering the earliest versions of the paper's mobile news alerts, and helped the *Times* become the first publisher with an application on Google Glass. One of the lab's researchers recently designed a brooch programmed to light up whenever a topic is mentioned that matches something the wearer read about online that day.

What good would that do, exactly? Boggie answers with enthusiasm, "We don't know yet!"

**3:10 P.M.**  
**A MONDAY**

STEVE DUENES, THE GRAPHICS EDITOR, IS REVIEWING a series of thirty maps that illuminate the ongoing crisis in Ukraine. The blinds in his office begin to lower automatically. ("There's a little chimp," he says.) Duenes is tall, with close-cropped hair to match the militaristic fervor with which he pushes his department, which has grown rapidly in recent years. The *Times* employs approximately 1,300 journalists, a classification that now includes much more than writers, editors, and photographers. There are videographers and developer-journalists and graphic designers, who insist that you not call them graphic designers. Every section of the paper has been affected by the Internet, but the graphics department is hardly recognizable from the days not long ago when, to accompany a story about Borneo, for example, it would simply produce a small black-and-white map of Borneo. Duenes's desk still produces traditional newspaper graphics, but it also now employs thirty-five people who have expertise in statistics, programming, cartography, 3D modeling, motion graphics, audio production, or video editing. At the department's two long desks, designer Haeyoun Park combs through data on the racial breakdown of police forces—a story the graphics team reported without any instigation from print reporters—while nearby Matt Bloch is updating the paper's digital hurricane tracker. "Tis the season," he says.

A breaking-news event might require eight members of Duenes's team, who are otherwise free to focus on the kind of in-depth reporting for which the *Times*' print reporters are generally known. Last August a graphics editor who had been tracking police data for four years discovered that the New York Police Department had more or less ended its controversial stop-and-frisk policy, which some critics had described as racial profiling. This was news to the reporters on the Metro desk, and the editor there assigned a story to go along with the graphics department's analysis.

The story, and the graphic, ran on the front page.

**A DAY IN THE LIFE**  
Clockwise, from top left: The page one meeting, an afternoon ritual; Ernie Booth, steward of the night-time presses; a mock-up of the next day's front page; an aluminum printing plate; pressman Steve McConnell; one of the machines that feeds paper through the ceiling to feed the presses upstairs.

**12**

POUNDS

Weight of the September 13, 1987, Sunday edition of the *Times*—a record.

**1,612**

Number of pages in the September 13, 1987, Sunday edition, also a record.

**27**

Number of printing sites in the United States.

**36**

Number of printing sites in the rest of the world.



**4:00 P.M.** TOM JOLLY IS TALKING INTO A SPEAKERPHONE. THE **A TUESDAY** page one meeting is about to begin.

“Washington, are you there?”

The page one meeting used to be at 10 a.m., but now the 10 a.m. meeting is simply called the news meeting because it covers so much more than what's going to be on page one the next morning. So now the page one meeting is at four o'clock, and it's four o'clock now.

Jolly, the paper's associate masthead editor—one of the most senior positions in the newsroom—is sitting at a large conference table surrounded by thirty editors in bright-green felt-covered chairs. For all the *Times'* investment in its digital momentum, page one of the daily print edition is still the most coveted space in *The New York Times*, and this conversation remains the paper's most sacred ritual.

Jolly worked at the *Times* for sixteen years before taking over the news desk, which means he's in charge of how the news is presented on every platform. He is dressed like a hip professor—blazer, cool glasses—as if attempting to bridge the gap between the paper's gray past and its digital future. To his left a screen is lowered to display both the Web and mobile front pages, which refresh constantly. Various smartphones rest on the table. One of Jolly's responsibilities is to decide when to send out a mobile alert to the 14 million people who have asked the *Times* to interrupt their lives when he thinks the news warrants it, one more way the sound of a newspaper landing on a driveway in the morning no longer heralds the arrival of the day's news. (“We've almost entirely gone away from paying attention to any print deadlines,” says Jason Stallman, the sports editor.)

Still, reporters want their stories on A1. Jolly goes around the room asking representatives from each section to state their case. It is a mostly polite debate—when the obituaries editor offers a remembrance of a yoga pioneer, a gruff, male editor is ribbed for his surprising knowledge about the topic—but the editor from Washington isn't shy about butting in. Jolly turns over the floor to an editor from international, who has a piece about the ransom demanded by Islamic State militants for James Foley, the journalist who had recently been beheaded in Iraq. It's an obvious candidate for the paper's top story—front page, top-right corner—but some editors have concerns. “Are you talking about the other side of it?” says Ian Fisher, the paper's deputy executive editor and previously the paper's Rome bureau chief. “The Italians would always say, ‘If you'd only stop paying, they'd stop taking Italians.’”

Dean Baquet, the paper's top editor, is worried that revealing too much about captives still under Islamic State control might put their lives in danger.

“We're not identifying their names and the amount of money—we can talk about the sourcing,” the international editor says.

“Let's talk after the meeting,” Baquet says.

The *Times* is occasionally mocked for its staid and deliberate pace, but it is in moments like these that the seriousness with which it approaches every aspect of its operation becomes clearest. There are few organizations with the resources to spend such time and consideration on stories that aren't primed to go

viral—though search-engine optimization and other tricks of the digital age do receive plenty of consideration. When the conversation turns to a vivid story from Liberia, where Ebola has overtaken a particular neighborhood in Monrovia, one editor proudly reports that she believes the *Times* is the only outlet with a reporter on the ground, which makes everyone happy until another editor says, “I think BuzzFeed actually has somebody there.” There is momentary silence.

The editors continue around the room. With Ebola and the Islamic State, plus the story pushed by the Washington editor and a national desk dispatch from protests in Ferguson, page one is running out of space. A metro editor advocates a story on jury selection because it has “a cool interactive element,” while sports pitches a piece on conflicts of interest in the United States Tennis Association. Art is a consideration, so the lights are dimmed, and a photo editor cues up the day's best photographs on a projector: There are images of a bombing in Gaza, a portrait of Foley, and a series of pictures from a *Times* photographer embedded with a group of Kurdish soldiers in Iraq. Attorney General Eric Holder is in Ferguson, but the photo “is pretty boring.” The most arresting image is a Liberian soldier enforcing an Ebola quarantine with a rifle around his shoulder and a baton he is swinging in the direction of a young girl. The next day it will run across two-thirds of the front page.

After a moment's deliberation, Baquet announces that the last slot will go to the jury story, “so we don't have the world's grimdest page.” The room empties as editors depart to relay the news to their sections, while Baquet, Jolly, and a group of designers stay behind to sketch out what the page might look like on a piece of paper. It is one of the only times that day anyone in the office uses a pencil.

» » »

**6:00 P.M.** ANDREW KEH IS ONE OF TWENTY REPORTERS IN A **A WEDNESDAY**

beige-walled room in the bowels of Madison Square Garden two hours before the New York Knicks tip off against the Dallas Mavericks, listening to Knicks coach Derek Fisher try to explain why his team has gotten off to such a rotten start. Reporters shout questions about injuries and lineups while Keh stands to the side in an untucked plaid shirt under a sweater, camouflage Nike sneakers, and black jeans with a reporter's notebook sticking out of the back pocket. Because tonight's game is starting late, Keh's editors have asked him to file a story before the first jump shot, so he's in the locker room hoping to talk to Tyson Chandler, the former Knick returning to face his old team. But when the locker room closes forty-five minutes before game time, Chandler still hasn't shown up. “We just wasted half an hour,” Keh says.

Keh got his start covering high school hockey games for *The Scarsdale Inquirer*, a weekly newspaper in a suburb of New York, and joined the *Times* as a news clerk, making copies and answering phone calls. After Keh helped a sports reporter with legwork on a series of stories about steroids, the paper hired him as a beat reporter covering the New York Mets, and then the Brooklyn Nets. Now his home is the Garden. Keh has

Architect Renzo Piano designed the *Times'* headquarters in Manhattan, which opened in 2007. It's near Times Square, which was named after the paper a hundred years ago.

# 32.8 MILLION

Size of the Times mobile audience in November 2014. Half the digital audience uses mobile devices.

# 38.6 MILLION

Total number of Times app downloads for smartphones and tablets, respectively, as of October 2014.



Dean BAQUET

EDITOR, THE WHOLE SHEBANG

to be at the press conference and in the locker room “in case a fight breaks out,” but the *Times* wants even its daily beat reporters to pursue ambitious stories. “We’re trying to separate ourselves from every beat reporter who covers every groin strain,” he says.

Even with a regular schedule of games, Keh’s job is not regular at all. He missed a game a few weeks ago when he landed a strange scoop. With an assist from the *Times’* research department, he had gotten in touch with a woman in Santa Fe who owned the domain name Nets.com and had been demanding that the Brooklyn basketball team pay her a seven-figure fee for the URL. Keh’s editor told him to get on



An editor used to ring a bell when the last page was sent to the printer and holler “Good-night!” to a mostly empty newsroom. These days at midnight, the room is full of journalists. The bell is gone. #



the next flight to New Mexico, where he landed less than twenty-four hours later. The woman agreed to the interview on the condition that Keh complete the *Times* crossword puzzle with her, which he did.

At the Garden, Keh returns to the media room to write an early game story and finds Scott Cacciola, another *Times* reporter, at the next desk. Cacciola is on an assignment from Baquet, who had just watched a miserable Knicks game and wondered what the heck Phil Jackson, their legendary and newly hired president, was doing with the team. (The Knicks were, at the time, 5-21.) “I’m supposed to stalk Phil,” Cacciola says.

The game is a blowout—the Knicks lose by twenty—so Keh has plenty of time to file a second version of his story from his seat in the press box just after the buzzer before hustling downstairs for post-game interviews. After Fisher’s press conference, Keh walks to the Knicks locker room, tweeting quotes from Fisher along the way. (The *Times* doesn’t require reporters to tweet, but encourages it and offers classes.) In the locker room, Cacciola trawls for lesser Knicks players who might comment on Jackson while Keh waits for Carmelo Anthony, the team’s star, who took forty-five minutes to shower and dress before

showing up to talk.

Deadline looms, so Cacciola offers to record Anthony while Keh returns to his laptop. At 11:07 Keh’s editor emails to say he needs the story in thirty-three minutes. The article Keh filed when the buzzer sounded was already posted on the paper’s website twelve minutes ago after a quick edit by only one other set of eyeballs—there was a typo in the first sentence—and he plugs in his earphones to pull quotes from the interviews. Cacciola returns with the Anthony interview. At 11:42, two minutes past deadline, Keh files his story, calls the copy editors to make sure it arrived, closes his laptop, turns to Cacciola, and says, “Let’s get a beer.”

**8:30 P.M.** **BILL DICKE TAPS HIS DESK ANXIOUSLY, LEANS A WEDNESDAY**

toward his computer monitor, and stares at the word "quarantine." He's trying to write a headline for a story on the arrival of Ebola in the United States, slated for tomorrow's front page. As assistant editor on the news desk, Dicke is among the last pair of eyes on the paper's front page and writes a lot of headlines. "Quarantine" is the best word, but at ten letters it has too many characters for a single column above the fold. The paper's first deadline of the night is in a half-hour. Dicke frowns. "There are seven pages for foreign, eight for national, and we're supposed to close them in some kind of order before nine o'clock," Dicke, who wears glasses and has a white beard, mutters. "None of the pages are even set." He rolls up the sleeves of his blue oxford shirt.

Facing Dicke in another cubicle, Lillie Dremeaux, a young woman with dark, curly hair, is considering what to do about a casualty. An activist in Israel was injured in an assassination attempt, and Dremeaux, the deputy editor on the news desk, is trying to sort out where that story should fit among the 300 articles, videos, blog posts, op-eds, and interactive features the *Times* will publish today. The *Times* website is the most coveted digital news space in the world, visited by 28 million unique users each month, nearly twice as many as *The Washington Post*'s. On this day Isabel Kershner, a reporter in Jerusalem—seven hours ahead—has just filed a brief account of the shooting, and the home page producer placed the story prominently. Dremeaux asks the photo editor if they have a picture of the victim—they don't—and, after considering it for less than ten seconds, tells the producer to bump the story down. "It certainly could explode into a war or something," Dremeaux says. "But he's not even dead yet."

The news desk is the center and the highest expression of the *Times'* transformation from once-a-day newspaper to twenty-four-hour news outlet. It's both the slowest and the fastest part of the *Times* operation—a place where Dicke can spend a substantial portion of the evening considering a single word while Dremeaux makes decisions in seconds. Most of the *Times'* editorial staff is spread throughout three floors of the paper's headquarters, and news is on the third floor. (The headquarters is at 620 Eighth Avenue, just off Times Square, which was named after the newspaper opened there in 1904. In 2007 the paper moved into a glass-and-steel structure down the street, an audacious addition to the Manhattan skyline. The new building is sleek and efficient—the window blinds rise and fall automatically based on the temperature inside.) Some desks are covered in old newspapers, others are clean and empty, a reminder that the *Times* operates in a post-recession, Internet-saturated media landscape where it still employs more reporters than any other major newspaper but fewer than it once did. (In December the *Times* offered buyouts to one hundred newsroom staffers. Dicke took the offer.) A studio in which a video crew films short clips for the website and mobile editions looms over the middle of the newsroom.

As it turns out, Dicke doesn't need to fit "quarantine" on a single line after all. That night, the San

**T**he newsrooms are packed with people and paper, but not as many people lately. In December a hundred editorial staffers took buyouts. But there are new jobs, too, in the R&D Lab, in app development, and in video production.

Francisco Giants win the World Series, thanks to a performance by pitcher Madison Bumgarner so dominant that Tom Jolly decides to swap in that story and moves Ebola to an inside page with a wider berth for a headline. But Dicke has other problems and stares at his plus-size computer monitor, which is flipped 90 degrees so that he can see the digital page as if it were a newspaper in his hands. Every article on every page appears highlighted in blocks of green, yellow, and red, signifying varying stages of completion and, thus, increasing levels of threat to Dicke's deadline. Elsewhere on the front page he changes the lead of one story because it's too long, then moves to another about how politics in Louisiana is becoming less eccentric. The starter headline reads, "Draining Color From Politics in Louisiana," which Dicke doesn't care for. "It's not a very exciting headline, but it is sort of the point of the story," he says, copying and pasting the text into a blank document. "I'm gonna see if I can do any better." Five minutes later, out comes "Colorful Rogues Make Way for National Issues."

Dicke meets his first deadline—barely—but 9 p.m. is only the beginning. Deadline for the first local edition is 10:45, followed by another at midnight, and a final call half an hour later. When Dicke finally packs up to leave just after 12:30 a.m., Lillie Dremeaux is still plotting out the next morning's home page and preparing to hand overnight duties to an editor in Hong Kong. In a previous era, after the last page was sent to the printer, an editor would ring a bell, walk toward the door, and holler "Good night!" to mostly no one, because there was no one left to yell at. Dicke looks around at colleagues midshift, their eyes pinned to computer screens.

"We no longer do that," he says.

>>>

**2.5**  
**MILLION**  
Average Sunday circulation,  
print and  
digital, for the  
six-month  
period ending  
September 30,  
2014.

**1.1**  
**MILLION  
POUNDS**  
—  
**836**  
**THOUSAND  
POUNDS**

Amount of black  
and color ink,  
respectively, used  
by the College  
Point Printing  
Facility in 2014.

**2:55 A.M.** **NATASHA SMITH AND MICHAEL GORDON PARK ON A SATURDAY** cobblestone street on the Brooklyn waterfront as they do every morning. Theirs is one of dozens of cars lining both sides of the street. They stand with a group of thirty or forty other deliverymen and women inside a loading dock waiting





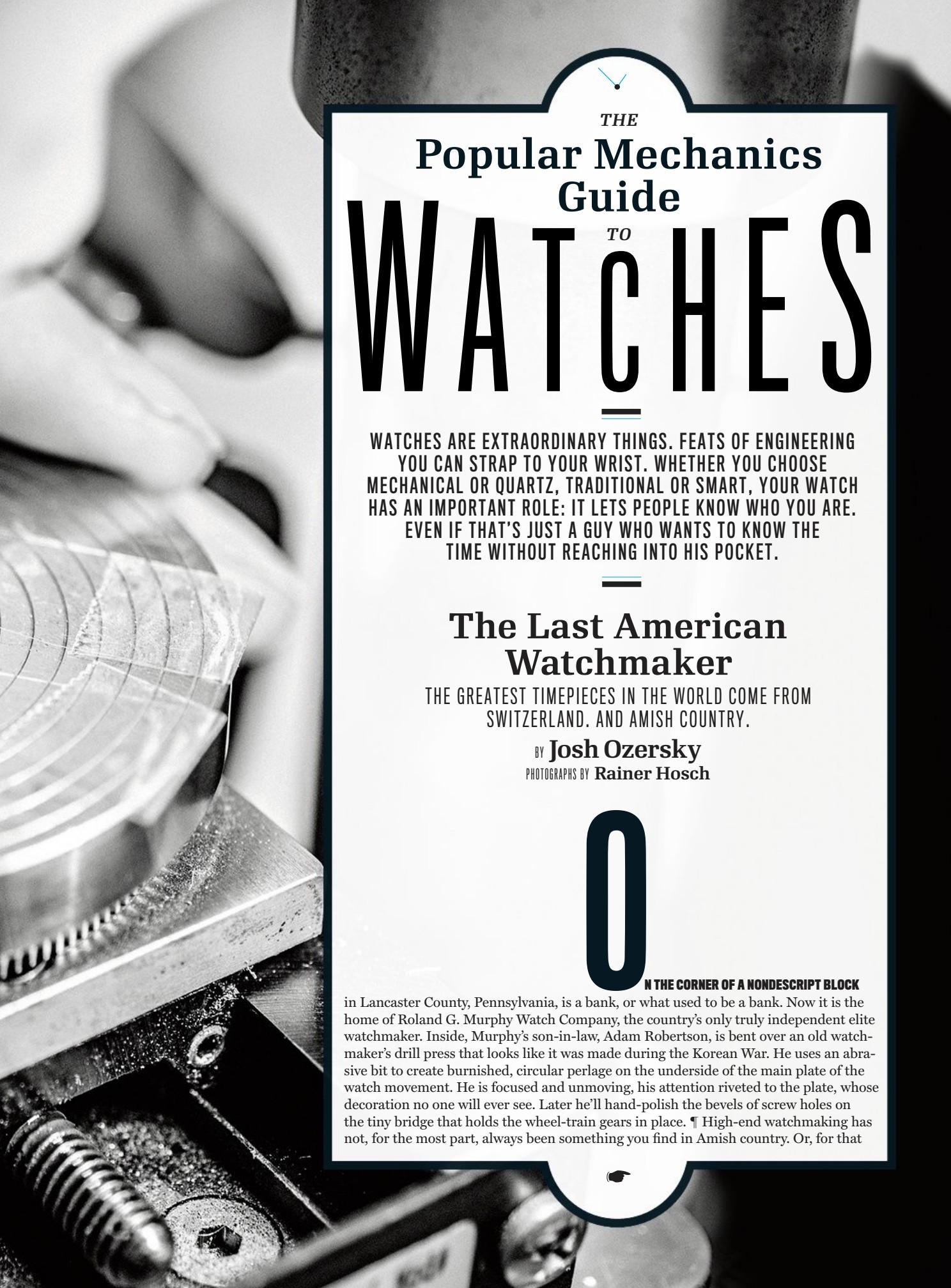
for one of Ernie Booth's eighty trucks to arrive. The Sunset Park Depot, as this cement room the size of a high school gym is known, is one of forty *Times* delivery centers throughout the New York area, and on this night it is responsible for the safe deposit of 12,559 copies across 215 different paper routes around the borough. Two hundred and thirty-three of those papers are the responsibility of Smith and Gordon, a husband-and-wife team that has driven a pair of routes together for the past three years. When the truck arrives at 3 a.m., the couple load five bundles of fifty papers each into a shopping cart and dump them onto one of the many wooden tables in the room, where they combine the front and inside sections. Smith tosses one copy aside after spotting a rip, and watches out for missing sections—"I can tell just from the weight"—which could result in a complaint on the report card every carrier receives each morning. (They get paid 50 cents per paper.) Smith and Gordon shove each completed paper into a blue plastic bag and toss it into a pair of shopping carts. Deliverers are allowed to show up anytime—Smith and Gordon arrive early, because late arrivals often get stuck with damaged copies—so long as they deliver their papers by 6:30 on weekdays and 8:30 on weekends. (In the suburbs, where commuters leave earlier, the weekday goal is 5:30.) The busiest hour in the depot is around 4 a.m., and by 5:30 all the papers have been removed and the door is shut, leaving a lone worker to fill a shopping cart with the damaged and discarded copies left behind.

**T**imes delivery trucks make more than eighty departures from the plant each night.



Smith and Gordon load their minivan and deliver all 233 papers in about ninety minutes. "Nothing like the cold to make you do it faster," says Smith, who's wearing a leopard-skin sweater and navy-blue beanie. On some blocks she and Gordon walk opposite sides of a street, tossing papers onto stoops, while on others they split up—Gordon carries an Ikea bag stuffed with papers as he walks down blocks with a high density of subscribers, while Smith drives sparser streets nearby. The longest stop is the five minutes it takes Smith to deliver six papers to individual apartments in a nursing home. One customer has asked her to hit his door with the paper so he knows it has arrived. Another customer's dog waits on the step and barks when the paper lands. At this moment, hundreds of thousands of copies of *The New York Times* are flying out of people's hands, a little action that starts a simultaneous morning ritual: A newspaper lands with a soft thud, and eventually someone opens the door and picks it up, reads it, and knows what is happening in the world. ■



A black and white close-up photograph of intricate mechanical watch components, including gears, screws, and a metal plate, arranged in a layered, overlapping composition.

THE

# Popular Mechanics Guide TO WATCHES

WATCHES ARE EXTRAORDINARY THINGS. FEATS OF ENGINEERING YOU CAN STRAP TO YOUR WRIST. WHETHER YOU CHOOSE MECHANICAL OR QUARTZ, TRADITIONAL OR SMART, YOUR WATCH HAS AN IMPORTANT ROLE: IT LETS PEOPLE KNOW WHO YOU ARE. EVEN IF THAT'S JUST A GUY WHO WANTS TO KNOW THE TIME WITHOUT REACHING INTO HIS POCKET.

## The Last American Watchmaker

THE GREATEST TIMEPIECES IN THE WORLD COME FROM SWITZERLAND. AND AMISH COUNTRY.

BY **Josh Ozersky**  
PHOTOGRAPHS BY **Rainer Hosch**

# O

N THE CORNER OF A NONDESCRIPT BLOCK

in Lancaster County, Pennsylvania, is a bank, or what used to be a bank. Now it is the home of Roland G. Murphy Watch Company, the country's only truly independent elite watchmaker. Inside, Murphy's son-in-law, Adam Robertson, is bent over an old watchmaker's drill press that looks like it was made during the Korean War. He uses an abrasive bit to create burnished, circular perlage on the underside of the main plate of the watch movement. He is focused and unmoving, his attention riveted to the plate, whose decoration no one will ever see. Later he'll hand-polish the bevels of screw holes on the tiny bridge that holds the wheel-train gears in place. ¶ High-end watchmaking has not, for the most part, always been something you find in Amish country. Or, for that

matter, in the United States. Typically, if you go looking for horological greatness, the kind of virtuosic craftsmanship associated with the greatest watchmakers, you go to Switzerland. If you are looking for scrapple, you go to Pennsylvania. But Murphy, the 53-year-old owner and sole proprietor of the watchmaking company that bears his name, is the exception. Like some of the small European companies directed by a single watchmaker, RGM makes fewer than 300 watches a year. In contrast, the brands worshipped by most enthusiasts—Patek Philippe or Vacheron Constantin—produce tens of thousands a year. Rolex produces 2,000 a day.

Of course, Rolex doesn't operate in a space that looks more like an Elks Lodge than a watch manufacturer, with a collection of vintage cameras filling shelf after shelf, along with various other mementos. But then Murphy himself doesn't fit the bill of a classic watchmaker. Burly, and with a thick head of salt-and-pepper hair and a bushy moustache to match, he looks more like a Pop Warner football coach. Like most watchmakers, he started out doing repairs, and found himself drawn to the silent, obsessive work of creating tiny universes of absolute order. After a few years of working on clocks, he



Clockwise from above: Roland Murphy peers through a rose-engine machine—an intricate engraving tool—during setup for the carving of geometric designs in his watch's dials; the solid-silver dial on the rose engine; the craftsman works in front of a vault in the old bank building that houses his business; a look at the bridges on the main plate of the RGM 801 model watch.



found his way to Switzerland, where he made the horological equivalent of the leap into the big leagues: training at the Watchmakers of Switzerland Training and Education Program, the Swiss watch industry's official certification program in Neuchâtel. Not long afterward Murphy landed at Hamilton Watch Company, where he eventually rose to an executive development position.

Hamilton, it ought to be noted, is a famous American watch brand. But the dirty secret of nearly all American watch brands, Murphy's excepted, is that they

are either owned by the Swatch Group outright or utilize movements built and exported by one of its subsidiaries. Most of the American watch companies you've heard about are using Swiss movements and Chinese casings. And none even tries to produce the kind of arcane complications—a whirling tourbillon that compensates for gravity, say, or a precision moon-phase subdial—associated with the Patek Philippes and Jaeger-LeCoultres of the world. RGM makes what are by far the most intricate and ambitious timepieces produced in

the United States. But they aren't just clones of Swiss watches either. They're inspired by the tough, durable railroad watches of industrial America.

The paradox, of course, is that this rugged practicality is actually pure poetry. A \$40 Casio G-Shock keeps more accurate time than a Breguet; a hot-pink Swatch a fourth-grader wears in the pool is more reliable than

a watch that costs more than her home. When you think about it, there's no reason for anyone to create in-house movements for an American watch. Murphy's quixotic commitment to craftsmanship has no value to anyone but an equally idealistic buyer.

Nowhere is this clearer than in Murphy's masterpiece, the Pennsylvania Tourbillon. A mechanical watch, no matter how perfectly made, is affected slightly by gravity. The rhythm of its escapement, the part of the movement that regulates timekeeping, varies slightly



based on how the watch is positioned. Not that anybody other than watchmakers would care or even notice. But the gravity problem stymied them, and so in 1801, Abraham-Louis Breguet patented a rotating cage to suspend the escapement, freeing it from the effects of gravity.

Manufacturing a tourbillon is incred-

ibly hard, which is why almost nobody does it. It's also why two or three guys doing it in a Pennsylvania bank building borders on the fantastic.

Two bridges hold the tourbillon cage in place. Murphy and his master watchmaker, Benoît Barbé, bore tiny holes in the bridges to mount the escape wheel, pallet, and balance. They friction-fit a gold ring inside each hole and a jewel into each ring. The 90-degree angle of the drilling, the depth of the holes, and the ring-and-jewel fittings must be precise to ensure the perfect relative positioning of the parts. The slightest variation would ruin the mechanism.

The completed tourbillon turns 360 degrees once per minute, driven by a tiny spring coiled around the central axis. All of this work, by the way, can only be done by hand. A few of the parts can be machined, but even those parts are usually made by equipment the two men created themselves.

Murphy doesn't build watches for himself or his buyer. He builds for an ideal: that things should always be better than what's necessary. "We don't design on the limit," Murphy says. "Think about the Brooklyn Bridge. How much weight do you think it had to bear when they built it? Some horse carriages? Some pedestrians? Today there are giant semi trucks going over it all day, and it supports that weight because it wasn't designed to the limit. That's something we take pride in." And it's something you won't find anywhere else in America. ■



## WATCHES THAT CAN TAKE A BEATING



**The watch:** MTM Silver Patriot (\$500)

**The wearer:** Albert Vargas, Los Angeles Fire Department

**The evidence:** "The Patriot takes constant abuse. There have been times when I've hit it pretty hard with forcible-entry tools or the four-inch hose. It gets bumped when I'm carrying the SCBA, our breathing apparatus. It's been exposed to house fires hotter than 1,200 degrees."



**The watch:** Luminox Navy Seal Chronograph (\$355)

**The wearer:** Pat LaFrieda, butcher

**The evidence:** "It's gotten soaked in blood. It's slammed against bone in production and bounced off wooden pallets in distribution. I wore it hunting in 10-degree weather. I had it on when I flipped my Polaris Sportsman 500 quad off a ridge. Still ticking."



**The watch:** Casio G-Shock G2310R-1 (\$99)

**The wearer:** Mark Clement, contractor; cohost of *MyFixitUpLife*

**The evidence:** "I've raked the band across flooring during installations, rattled it digging postholes for decks.

The most brutal beating was last winter, when it was 8 degrees. I was plowing snow, running a miter saw, and roofing. My phone battery fried, but my G-Shock never flinched."



## An Appreciation THE \$14 CASIO

**I**t took two weeks of searching to find my first serious watch, a tide-reading, GPS-enabled timepiece that, for \$400, would make me punctual and a better surfer. After adding it to my Amazon cart, I asked a friend, a savvy waterman in Hawaii, what he wore: "Cheap Casio." No mention of any special features—he just appreciated its function. So I ordered one of those instead.

Three months in and the W800H-1AV sits on the short list of near-perfect devices I've used. The digits are big enough to see the time and date with a quick glance. Its body is thick enough to find the LED light button, even with motorcycle gloves on, yet it still fits underneath a shirt cuff. I actually like it best with a suit—I'm in awe of the engineering wonders of more expensive watches, but the kitsch of a digital watch with a resin strap feels appropriately irreverent. With its ten-year battery and water resistance to over 300 feet, I'll probably lose the watch before it breaks. Fortunately, it won't take two weeks to decide on a replacement.

- ALEXANDER GEORGE

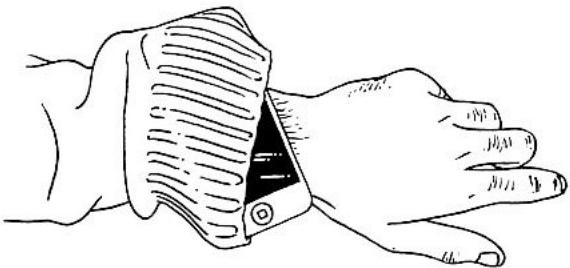
IF WE MAY . . .

# Your Phone Is Not a Watch

**F**or generations, if you asked a man the time, he'd snap his arm out to full length so the cuff of his shirt pulled back a little, then bend his arm at the elbow and glance down at the watch on his wrist. "Quarter o' four," he'd say. The whole thing took about a second. Here, too often, is what he does now: He shoves his hand into his pants pocket, or into the folds of the suit jacket beneath his overcoat, fishing for his telephone, which he produces and holds in front of his face. Then he pushes the button and the time pops up on the screen and he says, "Three forty-six."

This is no way to tell time. It's inefficient. It wastes time, which is the thing you're worried about in the first place—otherwise you wouldn't need to know what time it is. Plus, it's inelegant. A man without a watch looks unprepared, like a man who has to check his wallet to see whether he has any cash. A man should always have cash.

Your phone tells the time, yes, but your phone is not a watch. You need a watch.



## The Complications

THE SMALLEST DETAILS CAN MAKE THE BIGGEST DIFFERENCE.



### MINUTE REPEATER

A holdover from the pocket watch, repeaters have a lever on the side that, when flipped, activates tiny hammers that hit differently pitched gongs. Three tones, from low to high, signify each hour, quarter-hour, and minute, respectively. Minute repeaters often cost six figures due to the complexity of installing the many gears.

**Example:** Audemars Piguet Minute Repeater



### PERPETUAL CALENDAR

Mechanical watches with annual calendars must be reset three times every four years. (They count twenty-nine days each February to account for leap years.) A perpetual calendar, however, accounts for leap years only when they happen, requiring correction just once every hundred years, since each new century not evenly divisible by 400 (2100, 2200, etc.) does not contain a leap year. **Example:** Jaeger-LeCoultre Master

# WHEN WILL YOU GET A SMART WATCH?

Give yourself two points for each attribute you possess, then check your results.

- You own a watch.
- You own a smartphone.
- You own more than one smartphone.
- You see no problem in owning more than one smartphone.
- You own a Nest thermostat.
- You can program a DVR.
- You have a 4K TV.
- You prefer the Jetsons to the Bradys.
- You have referred to yourself, proudly, as an early adopter.
- You've stood in line for a smartphone.
- You have a friend with a smart watch.
- You've never made fun of that friend.
- You feel anxiety when your phone is more than five feet from you.
- You do not need a manual to pair a Bluetooth device.
- You can reset your own Wi-Fi router.
- You don't mind dictating text to a phone or computer.
- You love getting email.
- You have to respond to a text within one minute of receiving it.
- You do not need reading glasses.

- You have used a pedometer.
- You've considered buying Google Glass.
- You get *Battlestar Galactica* jokes.
- You make *Battlestar Galactica* jokes.
- You can write code.

## ANSWER KEY

**0-20.** You are at least a year from buying a smart watch.

**21-40.** All it'll take to persuade you is one more friend with a good experience.

**40 or more.** You may already be wearing a smart watch.

## THREE GOOD OPTIONS



**1. Apple Watch**  
Accelerometers integrate with iOS workout apps to make it a practical fitness tracker. Curved touchscreen and zoom-and-scroll crown are Apple beautiful.  
**Downside:** needs daily recharge.



**2. LG G Watch R**  
Notched bezel provides a vintage aviator feel as you cycle through texts, weather updates, and calendar appointments.  
**Downside:** chunky and slightly conspicuous.



**3. Garmin Vivoactive**  
Adds smart-watch functionality to Garmin's existing and excellent fitness trackers. Waterproof to 160 feet and has GPS, so you can track your run, bike ride, or swim.  
**Downside:** poor battery life in GPS mode.



### MOON PHASE

Originally used by sailors to track tides, the moon phase, which shows the visible portion of the moon, is now just an aesthetic element. It works by adding a dedicated gear that completes one rotation every twenty-nine and a half days, the length of a lunar cycle.

#### Example:

Baume & Mercier Clifton

### TOURBILLON

Although not technically a complication, there is no more beautiful feature for your wrist. Or more superfluous. Invented to prevent timing fluctuations caused by a pocket watch's static vertical orientation, a tourbillon holds the escapement in a rotating cage, offsetting gravity's negative effects. This is no longer an issue, since a watch moves with your wrist.

**Example:** Breguet Classique Tourbillon

### FLYBACK

Chronographs require three presses of the trigger to stop, reset, and restart the timer. With a spring attached to the running wheel, a flyback returns the counting hand to twelve o'clock with one push and almost instantly begins counting again. The function was created for pilots timing turns while flying in formation, where a fraction of a second counts.

**Example:** Tudor Grantour Chrono Fly-Back

## KNOW YOUR MOVEMENTS

What makes your watch work.

### QUARTZ

A battery sends an electric current to a tiny, tuning-fork-shaped piece of quartz, causing it to oscillate at 32,768 vibrations per second. The watch's circuits reduce that number to one vibration per second, or one hertz, and those pulses are translated into ticks by a tiny electric motor. (This is why mechanical watches, whose springs steadily release tension, have smoother second-hand movement than quartz watches.) Quartz's indifference to temperature fluctuations makes it well-suited for harsh conditions.

### MECHANICAL

A balance, or wheel, moves according to the energy expended by the tightly wound spring that powers the watch. On manual-wind watches, that energy comes from regularly turning the exterior crown to apply tension to the spring. Automatic, or self-winding, watches have a semicircular weight that pivots as your arm moves, turning the gears that wind the main spring.

GUIDE TO WATCHES

# HOW TO... CHOOSE A STRAP

The benefits and drawbacks of rubber, fabric, metal, and leather.

## RUBBER

**PRO:** Casual, comfortable, washable (with a little soap and water), waterproof.  
**CON:** Inappropriate in most formal settings.

## METAL

**PRO:** Durable, formal, shiny, sometimes interesting from an engineering standpoint (see below).  
**CON:** Occasionally pulls out arm hairs.

**MORE ON THIS WATCHBAND:** The MTM Special Ops Trigger uses a first-of-its-kind bracelet linked with ball bearings instead of pins, making the band much more flexible for a closer fit and no more pinched skin. The face, too, is impressively engineered: If you know you're going to be banging the watch around, you can rotate the bezel to raise it slightly to protect the crystal.



## FABRIC

**PRO:** Casual, comfortable, washable, easy to swap out.  
**CON:** Has a relatively short life span, could lead you to consider matching your watchband to your clothing.

## CIRCA 3500 B.C.

The sundial is invented. Not that anyone really had anywhere to be.



## 1953

Blancpain's Fifty Fathoms introduces a unidirectional rotating bezel—the outer ring that divers use to monitor remaining air—so that, if the bezel is bumped, the biggest threat to the diver is surfacing with more air than he expects.



## 2015

Filson partners with Shinola, expanding the classic fieldwear company to include its first line of wristwear.

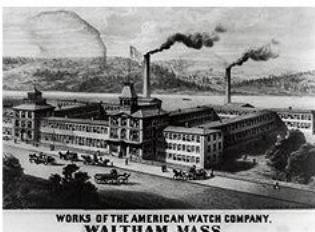
## LEATHER

**PRO:** Classic, formal, elegant, safe. Smells nice.  
**CON:** If you are prone to perspiration, that nice smell can be replaced with a pretty terrible one.

# Great Moments in Watchmaking History

## 1850s AND '60s

The first American watch companies, like Waltham Watch Company, Elgin National Watch Company, and E. Howard & Co., are established near Boston and in Illinois.



## 1914

Radioactive radium paint is used to make watch hands glow in the dark. After clients and employees lose teeth and develop cancer, the radium is eventually replaced by safe photoluminescent materials like zinc sulfide and strontium aluminate.



## 1940

IWC Schaffhausen introduces the Big Pilot's Watch, designed with a large onion crown (now IWC's signature) that allowed pilots to adjust their watches without removing their gloves.



## 1926

The Rolex Oyster becomes the first water-resistant watch after the free-spinning crown is replaced by a threaded crown, allowing it to screw in to the case.



## 1917

Louis Cartier creates the signature Tank watch, modeled on the aerial silhouette of the Renault tanks he saw while fighting for the French during World War I.



## 1960s

Deep-sea divers discover that helium atoms can leak into watches, building up pressure and cracking the crystal. In response, brands like Doxa create escape valves—automatic, one-way valves that release pressure as the diver surfaces.



## 1970

The first digital watch, the Pulsar, is released by the Hamilton Watch Company.



## 2014

Bathys Hawaii Cesium 133, the first self-contained atomic clock—and thus the only perfect timekeeper—debuts.



## 2012

The Pebble smart watch sells out before it's even introduced.



## 2011

Shinola opens in Detroit, delivering manufacturing jobs back to a city that needs and deserves them—and beautiful, accessible American watches to the rest of us.



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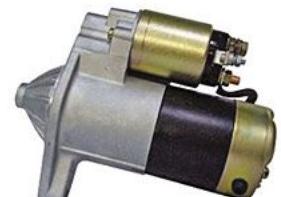
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✓Yes



✓Yes



✓Yes



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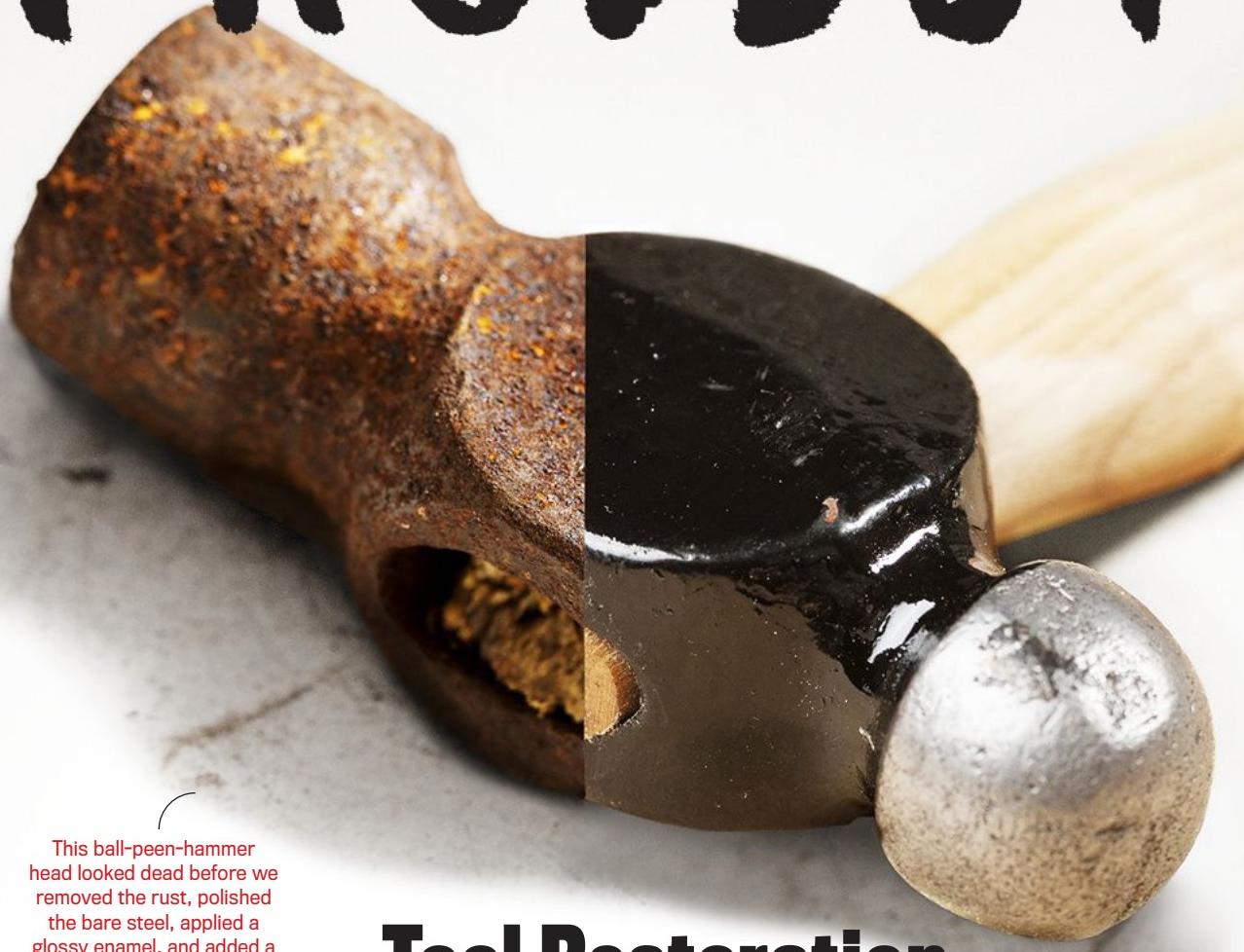
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# PROJECT



This ball-peen-hammer head looked dead before we removed the rust, polished the bare steel, applied a glossy enamel, and added a life-affirming new handle.

## Tool Restoration Clinic

Deep in the drawer, everybody has old, worn tools that could live useful lives again. To rescue one requires patience, sturdy abrasives—and vision. BY ROY BERENDSOHN

**A** NEGLECTED TOOL HAS AN ODD, MAGNETIC POWER. It pulls you in. Pick it up and the next thing you know, you're scraping away rust with your thumbnail, trying to make out the manufacturer's name. You vaguely recall how you came by it: a tag sale, or your father-in-law, or a neighbor who was moving away. "Everybody has them, these little hidden jewels," says contributing editor Richard Romanski, a fine woodworker and unrepentant tool collector. "Restoring them is pretty easy." We gathered a bunch of forlorn implements and went to work in his studio, a cavernous former church in North Salem, New York. We found that all it takes is some basic chemistry and a little work to salvage tools that look like they've been sitting on the bottom of the ocean for a century or two. ▶

# PROJECT

## Tool Restoration Clinic



1



3



2

THE MACHINE

THE RESTORERS

THE EQUIPMENT

Craftsman table saw, circa 1980s, purchased at a church auction for \$80.

Pictured in the photo above, from left: contributing editor Richard Romanski, editor in chief Ryan D'Agostino, and senior editor Roy Berendsohn.

Adjustable wrenches for disassembly, air compressor to remove debris, kerosene and a half-inch drill with wire cup brush for the rust, dead-blow hammer, rulers, machinist's square.

### Target: RUSTY, WOBBLY TABLE SAW

*Even a good machine can be rendered inoperative by a little rust and parts that go out of alignment or calibration.*

A table saw that earns its keep in an unheated garage, shop, or barn will soon rust. Condensation forms on its steel and cast-iron parts because they are cooler than the surrounding air (1). The rust makes it difficult to slide a piece of plywood across the table, which should be smooth and nonabrasive. It also makes it hard to raise and lower the blade or adjust its tilt. This early 1980s Craftsman saw cost \$80 at a church auction. Its table was

rusty, and its parts had been thrown out of alignment.

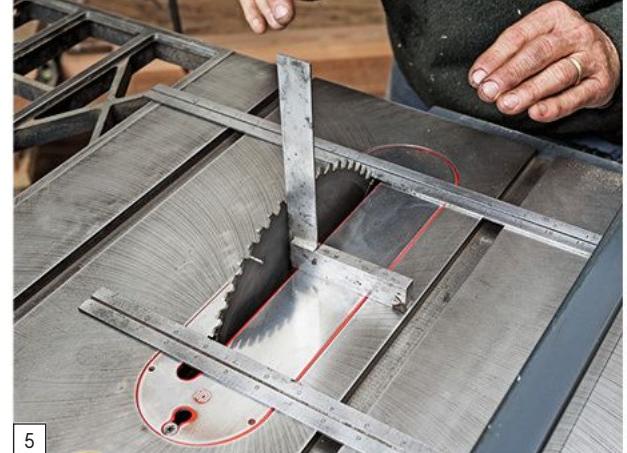
The first step was to move the saw to a warm, dry workshop. We took it off its rolling stand and hoisted it into a Ford F-150, then drove it down the street to Romanski's studio (2).

Next came disassembly. We unbolted the cast-iron wings from each side of the saw and removed the motor (3). We were pleased to find that the motor was a commercial-duty type with twin capacitors—one to start the motor turning and another to provide extra kick to the run winding. The motor's shaft and pulley were all in good shape. We used compressed air to blow accumulated sawdust and cobwebs out of the saw's cavity (4).

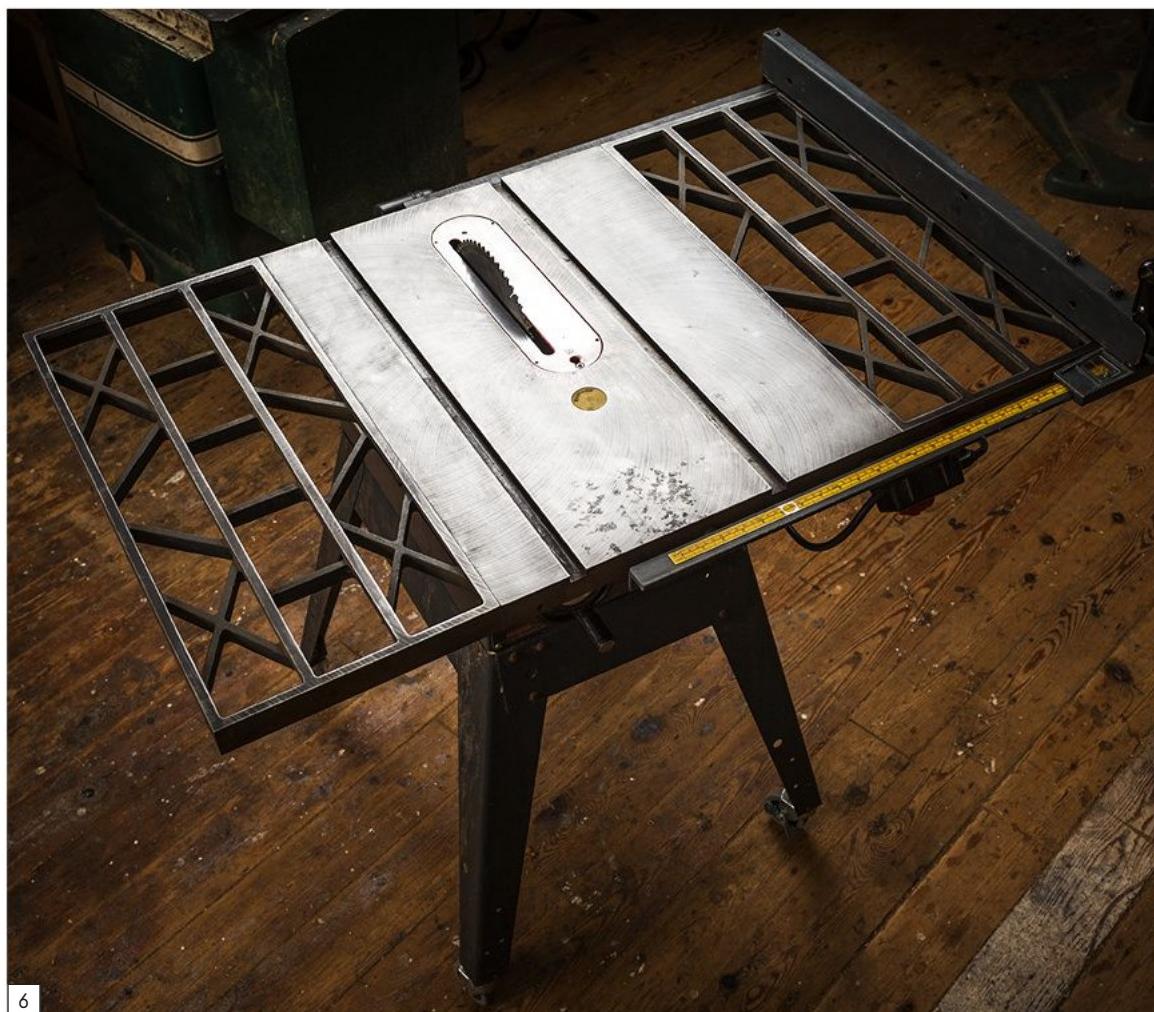
Next came removal of surface rust from the saw's table and



4



5



6

wings. We wet down the surface with kerosene as a cutting lubricant and left it alone to penetrate while we ate lunch. To buff the rust away, we chuckled up a variable-speed electric drill with a 2.5-inch abrasive nylon cup brush embedded with 240-grit aluminum oxide. At a low 500 rpm, with a back-and-forth movement, the brush removed the rust without marring the surface.

We mounted the wings back on the saw and found that we could align them with the saw table by flexing them slightly and carefully tapping them into position with a dead-blow hammer.

After placing a new 10-inch carbide blade on the arbor (the shaft the blade goes on), Romanski used a machinist's square to ensure the blade was perpendicular to the table. With the blade

at 90 degrees, the pointer on the saw's tilt scale should read 0 degrees—if not, the pointer is moved to the zero mark. Next we adjusted the fence and its locking mechanism to make it snug, a fussy trial-and-error process. **With the saw blade raised to its full height, we used a pair of steel rulers to check that the fence was parallel to the blade at the front and back (5).**

The tuneup was completed when Romanski reinstalled the motor and used a long steel ruler to align its pulley with the pulley on the saw's arbor shaft. We buffed on a coat of paste wax to provide rust protection and bolted the saw to its stand. Once it was in place, we made a few test cuts on some scrap pine to check for alignment. It was perfect (6).

# PROJECT

## Target: CORRODED HAND TOOLS

*Tools grow dull, and when they grow dull they are set aside, and when they are set aside they rust. And rust begets more rust, until they look like these. Time to dig in.*

Rusty tools turn up in the garden shed of the house you just bought. A friend gives you a boxful of them. **Often their handles are rotted away and their steel is so rusty that you could get tetanus just by looking at them (1).**

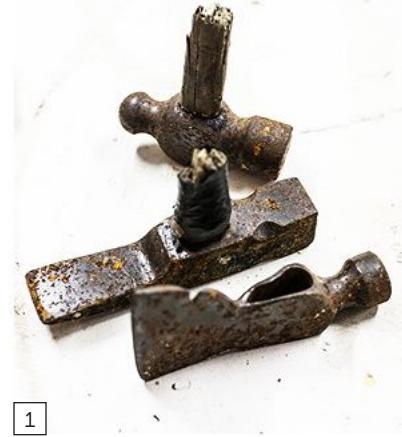
To restore a pile of ball-peen-hammer heads and a couple of hatchets, we first removed what was left of their handles. We sawed off the handle stubs using a handsaw, then clamped each head in a machinist's vise and used a punch to knock out the remainder of the handle.

Corrosion removal began in earnest when we submerged the heads in a bucket containing 1 gallon of white vinegar, an inexpensive supermarket item. We covered the bucket with a piece of plywood and let the parts soak. After about four hours **we took a few out and tried scrubbing off the rust with No. 1 steel wool (2)**, and wouldn't you know it, a little came off. There was hope. We dunked the tools back in the vinegar overnight, then hit them again with steel wool. (Steel wool is available in eight grades of coarseness, ranging from superfine, No. 0000, to extra-coarse, No. 4. We had good results with No. 1 wool, but you may need to go more or less coarse, depending on the amount of corrosion.) The rust came off. We rinsed the tools thoroughly in clear water to remove any last trace of vinegar and wiped them dry.

Severely pitted surfaces were then smoothed out using a 100-grit abrasive on a disc sander, and heinous damage—metal that had been peened over by a hammer blow, for example—was rectified by clamping the head in a machinist's vise and hand-filing the surface smooth. Finally, the tools were wiped clean with mineral spirits, primed with a rust-preventive metal primer (we used spray-on Rust-Oleum), and painted with a gloss alkyd enamel. Cutting edges on the hatchets were hand-honed on a series of water stones used for woodworking tools. **We completed each tool by fitting a hickory handle (3) through the cavity in the head.**

### THE TOOLS

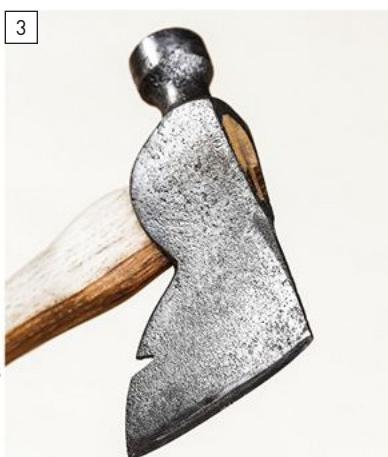
Various hammer and hatchet heads, rusted all to hell. Provenance unknown. You achieve an economy of scale when you restore tools in small batches.



1



2



3

### THE EQUIPMENT

White vinegar,  
No. 1 steel wool,  
rubber gloves, disc  
sander, hand  
files for sharpen-  
ing, mineral spirits,  
water stones.

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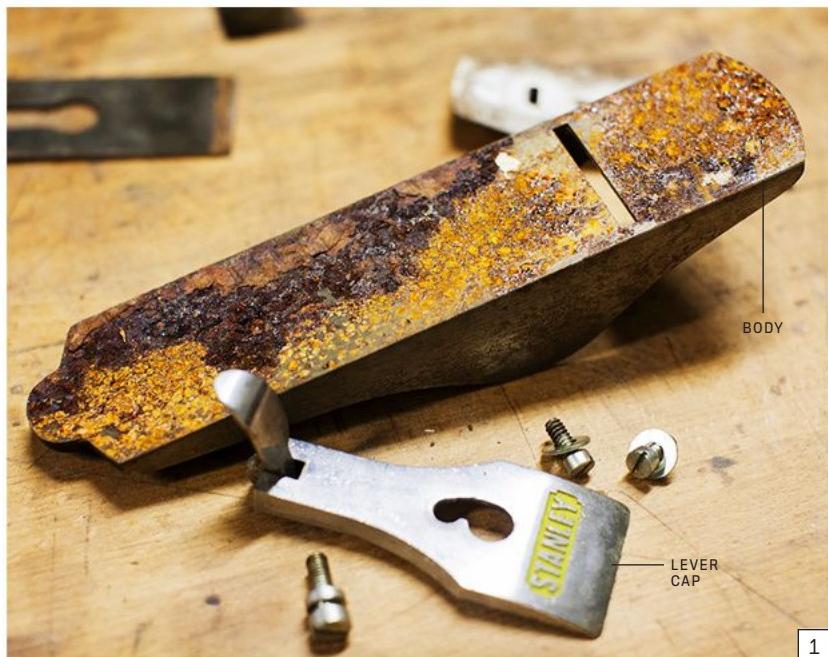
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## PROJECT

Tool Restoration Clinic



### Target: DULL PRECISION TOOLS

*Hand planes, machinist's squares, and adjustable combination squares are precision tools that require careful—okay, fussy—restoration and adjustment.*

Begin restoring any precision tool with a careful disassembly, **separating corroded parts from the clean ones** (1). In the case of the smooth plane pictured above, the body was not as badly corroded as it looked. We removed most of the rust with a hand wire brush. Then we lapped the sole of the plane on a succession of abrasive papers, beginning with 60-grit and proceeding through 1,000-grit. We taped

the paper to a workbench that has a dead-flat laminate surface and slid the plane body over the paper, swapping it end for end every six passes. We used a few drops of odorless mineral spirits as our cutting lubricant. The body came out flat and smooth, with only minor pitting.

Next we sharpened the plane iron on a horizontal wet sharpening wheel and even honed its back surface so that it was flat several inches behind the cutting edge (2). This ensures that the chip breaker will tightly mount to it and not allow wood shavings to be trapped and torn off.

After sharpening, we took the lever cap and the plane iron's chip breaker and buffed them out on a muslin buffing wheel with jewelers red rouge



THE TOOL

Stanley hand plane, circa 1960s.

THE EQUIPMENT

Wire brush, sandpaper, mineral spirits, wet polishing wheel, muslin buffing wheel with polishing compound, water stones.

**polishing compound (3).**

Romanski has more than forty years of woodworking experience, so he did the final inspection of the plane iron (4). He followed the machine honing with a careful trip over his water stones, leaving the plane iron with a mirror finish. He assembled and adjusted the plane and took it for a test drive on a piece of clear white pine. The result was a tool that cuts perfectly, taking long, silky-smooth shavings with every pass (5).

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# THE NEXT BIG THING

WEARABLE TECHNOLOGY



In partnership with the Paley Center for Media, in New York City, Popular Mechanics co-produced and presented a thought-provoking program in December about wearable technology and its impact on digital privacy, e-commerce, entertainment, fashion, and transportation safety.

Special Projects Director Joe Bargmann led a lively panel discussion among Nick DiCarlo, Vice President and General Manager of Immersive Products and Virtual Reality at Samsung Telecommunications America; Bob Hammond, Chief Technology Officer, Millennial Media; and Thad Ide, Senior Vice President, Research and Product Development, Riddell, Inc.

After the panel, entrepreneurs from three innovative startups—Skully, inventor of a Bluetooth-connected, head-up display motorcycle helmet; Voltaic Systems, makers of portable solar power technology; and Viawear, creators of high-end “smart jewelry”—delved into the technological challenges and potential growth of their respective businesses.

The event, The Next Big Thing in Wearable Tech, is available for viewing on paleycenter.org.

**Nick DiCarlo** of Samsung demonstrates the Gear VR virtual-reality headset while **Bob Hammond** of Millennial Media and **Thad Ide** of Riddell, Inc. look on; **Ben Isaacson**, founder and CEO of Viawear, makes his pitch; **Joe Bargmann** of Popular Mechanics leads panel discussion; **Jeff Crystal** of Voltaic Systems with About.com founder and Paley Center board member **Scott Kurnit**; **Dr. Markus Weller**, founder and CEO of Skully Systems, which manufactures innovative, tech-laden motorcycle helmets.

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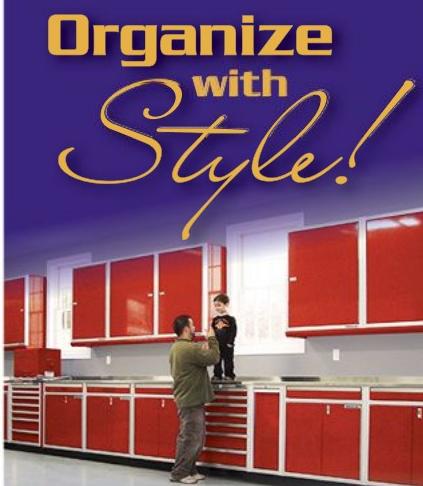


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DESIGNED BY ROY BERENDSOHN

# MONSTER MASK



EASY | REASONABLE | HARD

Difficulty:

Time: 30 minutes (or less)

Ages: 6 to 12

## Materials

QTY. | DESCRIPTION

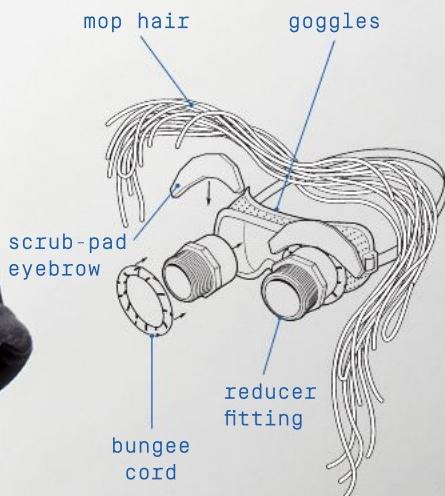
1	Pair flexible plastic safety goggles
2	1½-inch PVC reducer fittings
1	Brightly colored bungee cord
1	Cleaning pad
1	String mop

TOOLS Hot-melt glue gun, scissors

## Instructions

STEP-BY-STEP

1. Use a hot-melt glue gun to fasten the reducer fittings to the goggles.
2. Cut bungee cord to length, then wrap and glue the cords around each fitting, gluing the ends to prevent fraying.
3. Use scissors to cut the cleaning pad into two arch-shaped "eyebrows." Fasten them above the fittings with hot-melt glue.
4. Cut off a section of the string mop and glue its supporting band to the goggles' top shield.



● kid-only

● parent and kid

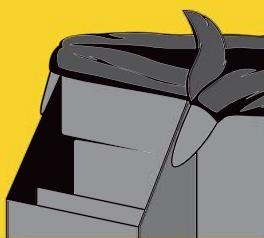


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